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March/April 1984

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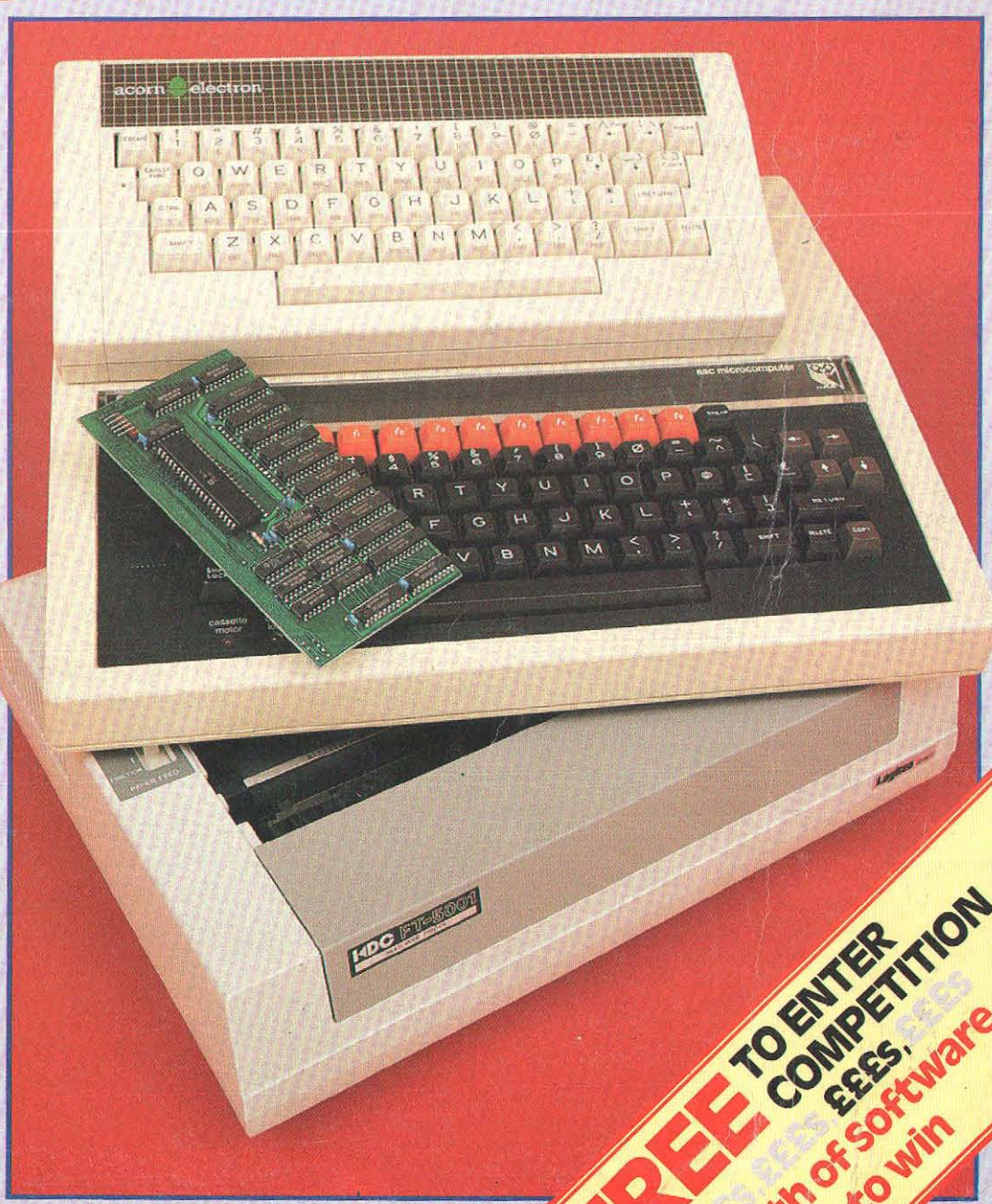

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A&

Volume One Numbe

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A&B Computing is constantly on the look-out for well-written articles and programs for publication. If you feel that your efforts meet our standards, please feel free to submit your work to us for consideration.

All submitted material should be typed, double spaced if possible, and any program submitted should be listed, a cassette of the program alone will not be considered. All programs must come complete with a full explanation of the operation and, where relevant, the structure; cassettes of the program should also be included so that screen photographs and printer dumps can be included to illustrate the article. (Cassettes will, of course, be returned in due course).

All submissions will be acknowledged and any published work will be paid for at competitive rates. All work for consideration should be sent to the Editor of A&B Computing at our Golden Square address.

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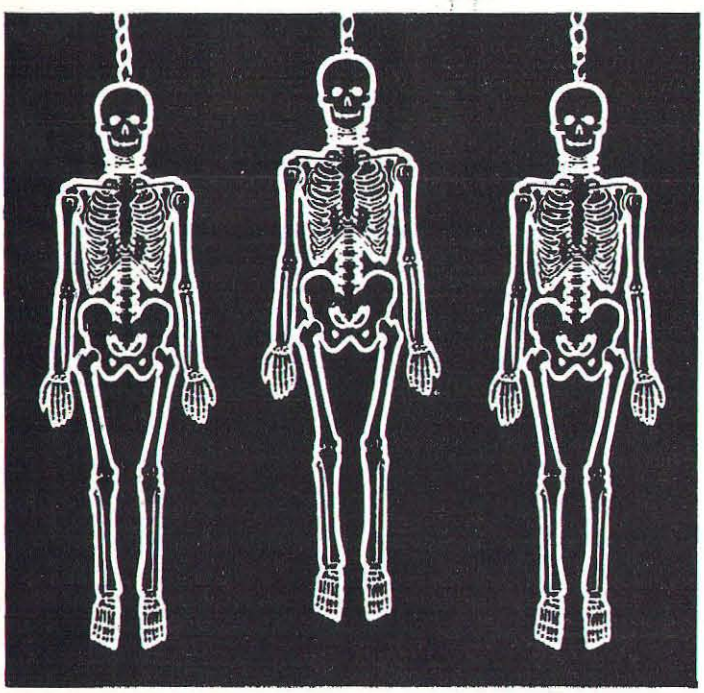

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At Software Supermarket, we play all the programs we can get for the BBC Micro (and the Spectrum - send 50p stamp for a catalogue for either! FREE catalogue with each order). We put just the best of each type of program into our ads and catalogues. We don't have the biggest list of programs - just the ones you'll really enjoy for a long time. They come from many different companies, large and small, famous and just-about-to-be-famous. We produce no programs ourselves, so our choice is quite impartial.

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PINBALL ARCADE DESIGN YOUR OWN PIN-TABLES! This really is a d-i-y program. One example pin-table is included, but the fun is in designing your own (and saving them). PLAY is very convincing as you move the flippers, call the next ball and pull the lever. You can add or take away 38 different springs and wires and flashing lights and bumpers, move them all around the table, alter their scores, or their bounce, alter the flippers, even tilt the table. You can change just about everything quickly and easily. And then you can play with the result. Be a Pinball Wizard, now, and design the perfect pin-table. NO JOYSTICKS. *(Kansas)* £10.00

TWIN KINGDOM VALLEY THE FIRST GRAPHIC ADVENTURE FOR YOUR BEEB! Not only is it a good adventure but all 175 locations are drawn in full-screen hi-res graphics - and the drawings are beautiful, too! (Some contain clues as well.) 36 commands: plain English input: real-time adventure and 6 control options. It is simply the most sophisticated (and the prettiest) adventure we've ever played on our Beeb. *(Bug-Byte)* £9.50

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CYLON ATTACK *"OUTSTANDING ... Quite simply excellent ... the graphics leave most other games standing." (MicroUser)* It is pretty staggering - so are the 3D graphics. You will believe you are launching from and docking with a mothership: you will see and feel you are refuelling. You will know just when you can kill the enemy as your sights change shape. **UNIQUE 50-PLACE HI-SCORE TABLE CAN BE SAVED FROM GAME TO GAME.** Now why don't all the programs do that - it's a great idea. JOYSTICKS O.K. *(A & F)* £7.90

TRAFALGAR Totally original new game, as you command your way through the graphic battle of Trafalgar. Great full-screen overhead line-of-battle pictures, as you choose your enemy ship and then sea-level viewpoint as you watch the two ships fight to the death. 1 or 2 players: FIRESHIPS can be launched (and blown up, if you're smart): your broadsides are very controllable and the graphics are very watchable. It makes a nice change from the space race. NO JOYSTICKS. *(Squirrel)* £8.00

DAMBUSTERS Combines the excitement of 'Scramble' with the skill of inflight simulation. Join 617 Squadron and destroy the Mohnesee dam with your bouncing bombs - if you get your lights right, avoid the enemy fighters, the hidden gun batteries. And if your distance counter works. Very exciting: very skillful: unique. It gets more difficult each time you fly. No joysticks. *(Alligata)* £7.95

SNOWBALL *"The puzzles are logical and the program is enthralling ...well worth the money." (MicroAdvent)* The greatest ever text adventure. Over 7 thousand locations! As Kim Kimberley, agent extraordinary, you must safeguard Snowball 9. 700 messages: vocab over 200: every object has a purpose. Written in super-compact a-code. Helpful manual. NO JOYSTICKS. *(Level 9)* £9.90

TRANSISTORS REVENGE *"Clever idea... noisy, fast, colourful and compulsive." (YrComp).* Original: great sound and action: good full-screen graphics. The game is set inside your computer as you guard the CPU from the attacks of the chips! 50 alien chips on each sheet: every 4 levels, life gets harder! You choose whether to continue with a game or enter the hi-score ladder. NO JOYSTICKS. *(SoftSpot)* £6.95

THE HOBBIT *"Sheer adventure...a must for all aspiring adventurers." (CompAnswers)* At last a BBC version of one of the greatest adventures ever! Text only, but every detail of the plot is the same as the famous Spectrum version. FREE 285pps illustrated book with clues. Unique real-time quest: 80 locations: massive vocabulary: accepts multiple commands in plain English: 16pps manual. It IS as good as you've heard! NO JOYSTICKS. *(Melbourne House)* £14.95

TRENCH *"Nothing short of manna from heaven." (PersCompNews)* The least exciting name we've heard for one of the most exciting games we've played. How about flying your Beeb/X-Wing Fighter down the 3D Trench towards the Death Star-style target, dodging the tie-fighters as they attack? 9 skill levels: sensational graphics. JOYSTICKS O.K. *(Virgin)* £7.95

PIMANIA *"This game can damage your brain." (PersCompGames) "An original and amusing game" (PersCompNews)* **AT PRESSTIME YOU CAN STILL WIN THE £6,000 GOLDEN SUNDIAL OF PI! Simply by solving this wonderfully witty adventure. Brilliant use of music and graphics.** NO JOYSTICKS *(Automata)* £10.00

BOMB ALLEY *"Very addictive game...good value for money." (Beebug)* Beautifully executed 3D simulation of an air-sea battle. Just defend your ships against air attack. Some of the most complex graphics we've seen on the BBC. JOYSTICKS OK. *(Software Invasion)* £7.95

PARAS NEW graphic battle game: NOT an adventure or arcade game. A gripping simulation of small-unit actions. Command 15 men: 10 possible actions for each man, each move: 10 skill levels: 2-part game, first secure your retreat and then destroy the bridge. Absorbing. NO JOYSTICKS *(Lothlorien)* £6.95

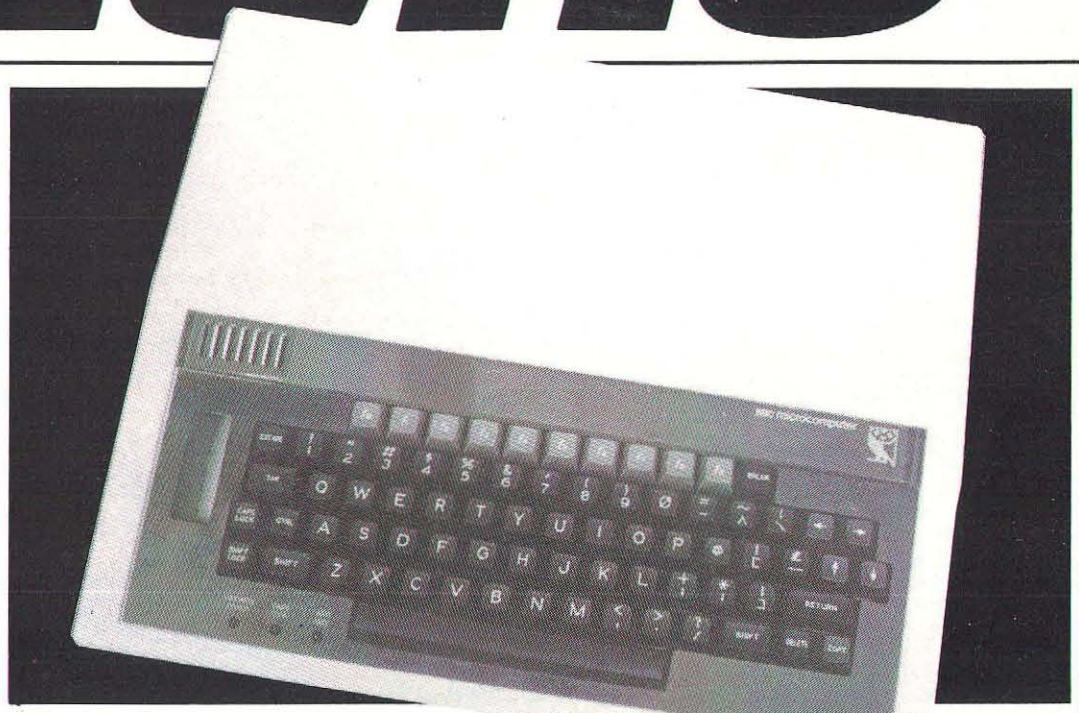
747 FLIGHT SIMULATOR *"The best flight simulator around that runs on the Beeb...a must for all budding pilots." (PersCompNews)* By Captain Roger Selby of British Airways. You're in charge of a 747 which you may land at either Heathrow or Gatwick. 11 control keys: 11 control keys: clear instrument display: good runway view as you approach: 8-pps on-screen flight briefing. Realistic crashes, but instructive flights too! NO JOYSTICKS. *(Dr Soft)* £8.95

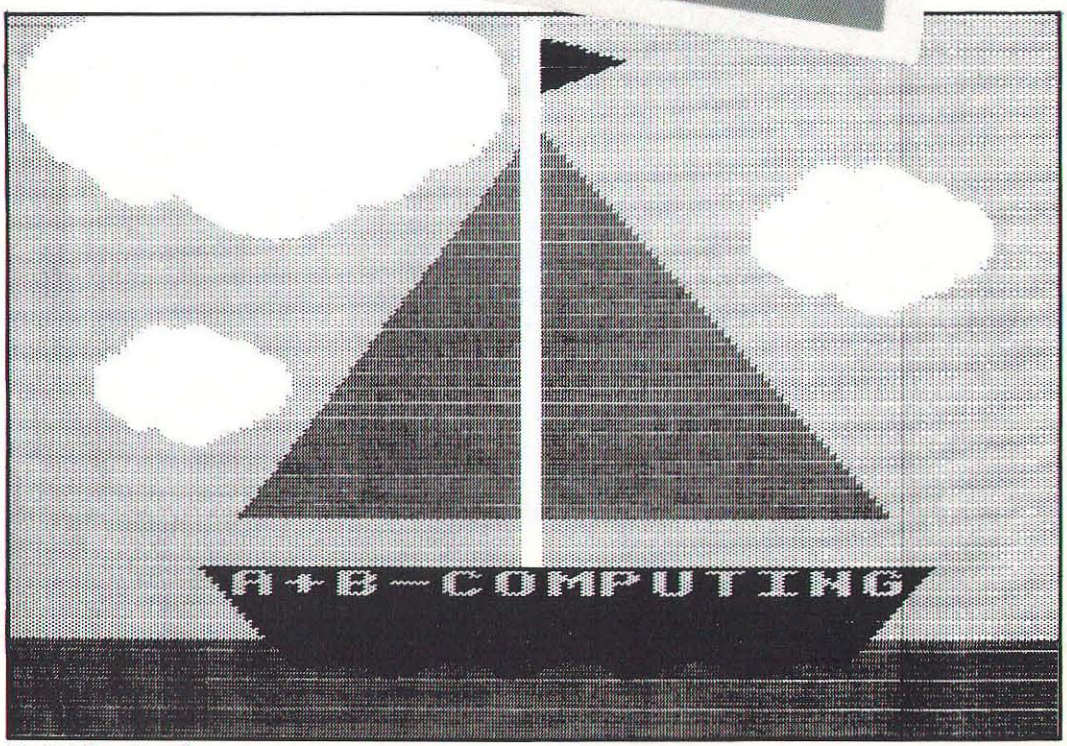
Menu

This sixth issue of A&B Computing completes a full year of the magazine, an exciting period for all BBC users and of course just the beginning for many new owners of the Electron.

Acorn have kept us busy with the release of a teletext adaptor and the knowledge that future products will include 16 and 32 bit processors, thus ensuring the future of the BBC in an ever more competitive field. There are also rumours of an Advanced Business Machine. Clive Sinclair's new baby, the QL, uses a 32 bit processor and retails at exactly the price of the Beeb. Neither the software nor the interfacing abilities of the machine are as yet proven but it is clear that the competition is hotting up around the £400 price bracket.

Most importantly over the past year, we have witnessed the growth of a thriving software industry based upon the BBC Micro. It has also become apparent that many of the schools employing BBCs are writing their own software for use in the classroom. A&B likes to make the best of these programs widely available by publishing them on its pages. The magazine is equally willing to act as a central library for educational programs, supplying descriptive information and addresses to contact. Therefore if any schools wish to write to A&B as its new address, No. 1 Golden Square, London W1R 3AB, detailing the programs they have developed and where they can be found, then we will publish the information in future issues.





Turtletalk sets sail.

LOOKING AHEAD

You never know, some of your software may one day run in a Computalab. In this issue, A&B goes back to school for a look into the future with Eliot-Medway's computer classroom. We have two important educational programs: the most comprehensive version of Hangman we have seen and All Change!, alot of fun learning the alphabet and relating upper and lower case characters.

As usual in A&B, there is no shortage of exciting and testing games, advice on available hardware and extended looks at programming ideas and techniques. There is a new series introducing BBC BASIC and Turtle Talk, the first of two parts listing and documenting a powerful turtle graphics program for the BBC, and the Electron. We also feature the BBC at work in industrial training and the Aries RAM expansion which looks set to expand the Beeb's capabilities.

A&B Computing has had an exciting year in common with all BBC users and we look forward to the further growth which the BBC Micro has always promised.

News

BBC NEWS

Concerning the article on the Liveshow in the last issue of A&B Computing, the BBC have asked us to point out that the Producer of the show was David Allen and the Director Patrick Titley. BBC Publications have a new book out to coincide with the second showing of Making the Most of the Micro. Written by Ian Trackman and Henry Budgett, the book includes programs which demonstrate some of the ideas covered in the television series.

ACORNSOFT RELEASES

Acornsoft have released six Grandmaster quizzes, developed from the Weidenfeld and Nicolson quiz books from by Ivan Berg software. All the programs will work on both the BBC and Electron and cover topics such as Theatre, Music and Science Fiction. There are various options on how to go through the 300 questions, which are set (with no little humour) by expects like Sheridan Morley, Steve Race and Anthony Holden. The programs cost £12.65 each and include two cassettes, the program and quiz data.

Acornsoft have also entered the world of business with a set of MIRLE software. The small business system covers Invoicing, Order Processing, Stock Control, Purchasing, Mailing and Accounts. The programs are conventional menu driven units but offer attractive displays and ease of use. Certainly if you intend to employ your Beeb in a small business environment, then the MIRLE package may be what you are looking for. The programs are available on 40 track disc and 80 track versions will follow. All the programs are capable of producing the necessary hard copy.

CASSETTE-TO-DISC EXCHANGE

Owners of Acornsoft software on cassettes will now be able to obtain cheap disc versions through a new home computing service. In exchange for the cassette, Acornsoft will supply a disc version of the same title at a 50% discount. Customers wishing to use the service should return just the cassette without the outer packaging and enclose the relevant remittance. It is recommended that potential customers check the prices and availability of programs in 40 and 80 track format in the latest catalogue first. Send to: Disc Replacement Service, Acornsoft Ltd., c/o Vector Marketing, Denington Industrial Estate, Wellingborough, Northants NN8 2RL.

MICROPULSE

Northern Computers now have a new 3" disc drive for use with the BBC. It's called the Micro pulse and comes complete with double sided 100K utility disc, cable and user manual. Software on cassette or 5¼" disc can be easily transcribed onto a 3" disc using the Micro Pulse Mirror software system.

Currently retailing at £169.90 exclusive of VAT, the Micro Pulse disc drive is available from Northern Computers, Churchfield Road, Frodsham, Cheshire.

ADDENDA

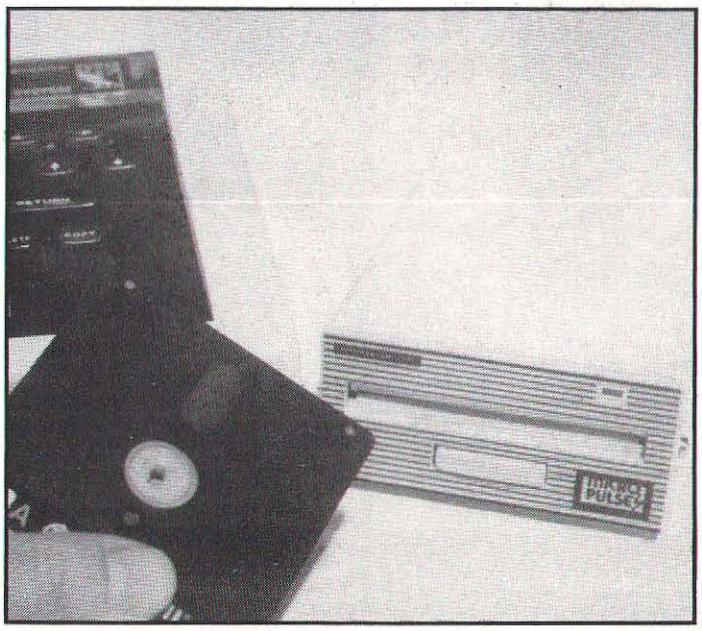
Apologies to readers who were confused by the lack of a couple of lines which went missing from the educational 'Addsnap'. They were:

```
850 PROCdelay(0.5)
860 REPEAT
870 number(pos)=RND(total-1)
880 PROCcheck(pos)
```

CUBE CATALOGUE

The new catalogue from Control Universal makes interesting reading for BBC owners. There are is an interesting range of BBC add-one, software, and extensions, including Beebex, which extends the BBC to enable it to run all the CUBE modules, CUGRAPH, a high performance VDU interface, and EuroBeeb, a CPU card which offers more features on a Eurocard than any other controller — including BBC BASIC.

There is also the FLEX Operating System, an easy to use software tool for the 6809 processor which allows Pascal, BCPL, FORTRAM, and Forth to be run on a CUBE system. Also included are BBC Micros and accessories, printers, VDUs and so on. A reply card enclosed with the catalogue invites users to send for microprocessor and BBC BASIC reference cards free of charge. The catalogue is available from Control Universal Ltd., Unit 2, Anderson's Court, Newnham Road, Cambridge CB3 9EZ. Tel: 0223 358757.



BIOLOGICAL BEEB

Thomas Nelson and Sons have just launched a series of five packages providing software for use in A-level Biology courses, and with some limited use at O-level. The NELCAL Advanced Biology series follows the text book Biology, A Functional Approach and provides a range of interactive software exploring experiments and techniques which cannot be done by students themselves.

Each package contains the software plus teachers' notes containing information on the theoretical background to the topic and suggested uses for the programs. Each package costs £23.50 plus VAT. The individual packages are Genetics, Evolution, Sample, Behaviour and Biological Statistics Utility.

Further information from Thomas Nelson and Sons Ltd., Nelson House, Mayfield Road, Walton-on-Thames, Surrey KT12 5PL. Tel: Walton 246133.

NETWORKING CLUB

Bedford College of Higher Education, with their 25 station Econet system, are behind the formation of a new club for establishments running BBC networks, of which there are now 500 plus in Britain.

The Network User Group plan to pool expertise and experiences into a central base and then communicate the information through meetings and a newsletter/magazine. They will also act as an effective pressure

group through which to pass on complaints to manufacturers.

The group will also concern itself with alternative network systems other than Econet and are especially interested in XENIX, a version of the UNIX operating system with the 32-bit processor board currently planned by Acorn, Microsoft and Logica.

Bedford College is prepared to organise the start of the venture and the running of the group. If anyone is interested in more information then contact Tom Short or Mike Taylor at The Computer Centre, Bedford College of Higher Education, (Mander) Cauldwell Street, Bedford MK42 9AH.

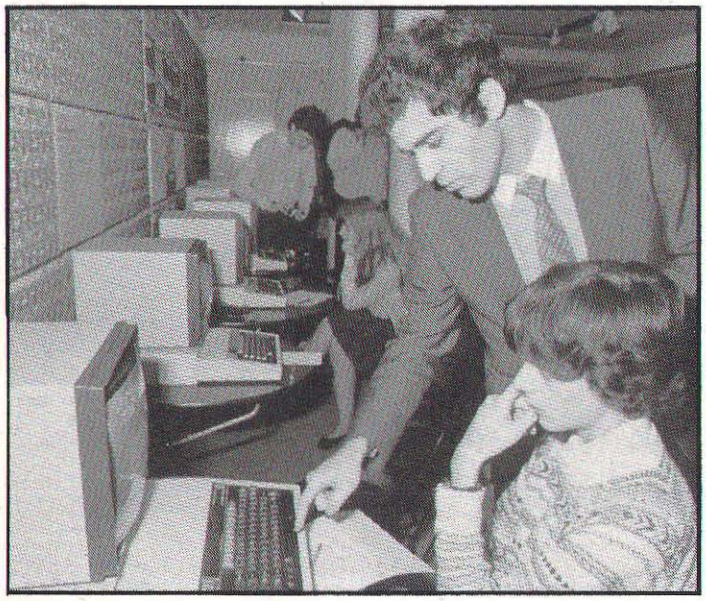
ACORN NEWS

Following the donation by the Queen of five microcomputer networks made by Acorn to India to mark her recent state visit, comes the news that Acorn, in the form of Chris Curry, have been negotiating a deal worth up to £100 million. The Queen's gift was bound for use in Indian universities where the system is to be evaluated and education software produced for a schools programme.

Back in Cambridge, Acorn are involved in a joint venture with Cambridge Computer Laboratory to market a second generation Cambridge Ring network. The 16-bit CMOS device will be a plug in component for the BBC. It will offer the capability of putting voice and video signals on the network as well as computer data. This system is very likely to replace the Econet Acorn now offers. Existing machines will be able to upgrade.

The Acorn Compuer World Chess Championship was a tremendous success. Twelve monitors on Acorn's local network system were placed in the main hall so that visitors could see the current state of play. The driving software was a converted Acornsoft Chess program with the names of Korchnoi and Kasparov or Smyslov and Ribli appropriately displayed. There were further monitors for journalists and guests at the tournament. A BBC Micro word processing system was there to prepare draft telexes and there were even sample screen dumps to illustrate interesting stages of play. CEEFAX also made use of a BBC and a modem to keep up a move by move commentary on the game.

Gary Kasparov, who won his semi-final, went on to beat ten junior players, six games to four in a challenge match at Acorn's Covent Garden showroom.



David Johnson–Davies congratulates Bronislaw Przybyla.

GO PROVES A WINNER

The world's first Go-playing championship for computers witnessed, over the weekend of January 7th/8th, a titanic struggle between eight programs running on BBC Micros to make their programmers champion computer Go player of the world.

The competition sponsored by Acornsoft in conjunction with the British Go Association and A&B Computing, took place at Acorn's Covent Garden showroom and involved finalists T. Hart from Co. Down, M. K. Scott from Cambridge, M. Reiss from Brighton, D. Skidmore from Nottingham, A. J. Lucas from Oxford, J. Hobson from Bedfordshire and eventual finalists, R. J. Granville from Malvern and B. K. Przybyla from Swindon.

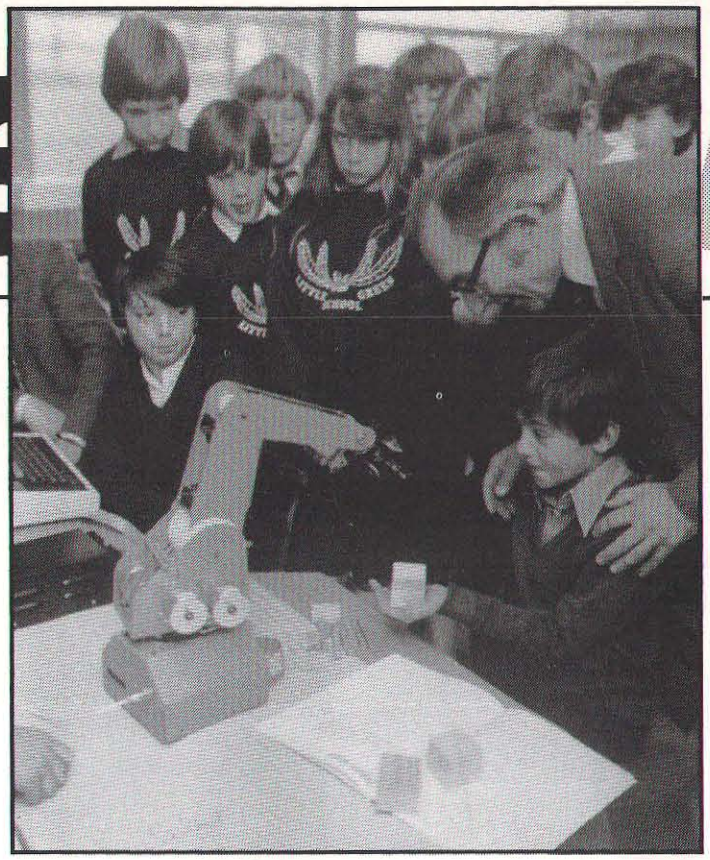
The program continued the battle into Sunday afternoon, stone by stone and the winner emerged. The adjudicator Matthew Macfadyen, ex European Champion and five times British Champion, came out in favour of B. K. Przbyla, who is a freelance consultant specialising in production control systems for micros. He won a handsome (and large) cheque for £1000 and will help Acornsoft develop the commercial version of his program.

David Johnson-Davies, Managing Director of Acornsoft Ltd, said that they would be selling a Go-playing program by the summer. The hope is that a moderately strong computer game will encourage people to take up Go and help to popularise the game. The commercial importance of a Go-playing program can be judged by the presence at the tournament of the Vice-President of a Japanese computer company. The game is extremely popular in the Far East where it originated.

BBC Micros and their programmers fight it out.

CONTINUED OVER

News



TEXT ONLY

January saw the launch of the first Mosaic bookware titles, both available for literary Beeb users. The books come packaged with a game on cassette. £9.95 is the all in cost for both the game and the book and demand has already forced a reprint.

The two titles are My Secret File, based on the children's best seller, and the classic Science Fiction tale The Pen and the Dark by Colin Kapp. The programming is done by Phil Nathans and Keith Campbell. The first tape replicates the record keeping layout of the File and the second is an excellent adventure game in its own right.

My Secret File allows users to compile their own confidential record of diary dates, possessions and dossiers on friends and relatives. The Pen and the Dark adventure casts adventurers in the role of Colin Kapp's hero, Fritz van Noon. Their task is to solve the mystery of the indestructible pillar of darkness left by an alien race and to unlock the riddle of contra-energy. The book offers some pointers to the game but does not provide all the answers.

ALL THE FUN OF THE FAIR

A major exhibition of computer hardware and software for schools is taking place at Dauntsey's School, West Lavington, Devizes, Wiltshire. The fair is supported by the MEP, Wiltshire County Council and ISMEC. All the major producers of educational software and books will be in attendance and most of the smaller outfits will be competing to show their expertise in the educational field. Primary and secondary level education will be covered.

On the hardware side there will be exhibits of interfaced equipment for science teachers and administration systems. There will be extensive car and coach parking and creche facilities. Entrance is free and all teachers and educationalists will be welcome. The fair runs from 2nd to 3rd of March between 10am and 6pm.

HANDS ON ROBOTS

Little Green School, Croxley Green, Richmansworth, recently benefited from the arrival of a prototype robot and software. The robot turned up courtesy of Micro Scope Ltd., and was obviously warmly greeted.

The arrival is part of a scheme to enable children to develop their own practical computer/robot applications and give them real hands on experience of programming which can demonstrate practical and visible success.

The robot can move its arm in three dimensions and can perform simple block building tasks and games. Further information from; Chris Sealy, Micro Scope Ltd., Mill Lane, Taplow, Maidenhead, Berks SL6 0AA.

COMPUTER CAMPING

It's already time to book your summer holiday. Instead of sunny southern Europe, why not book up for an advanced computer holiday run by PGL? They are offering one week holidays at Heriot-Watt University and Portsmouth Polytechnic. Micro and mainframe computers will be employed in teaching. At Heriot-Watt they offer lectures, demonstrations, excursions and hands on experience of the latest computer technology. At Portsmouth the computing staff specialise to advanced programming and highlevel languages. Sounds just the job for the ambitious Beeb user. Further details from: PGL Young Adventure Ltd., Station St., Ross on Wye, Herefordshire HR9 7AH. Tel: 0989 63511.

TORCH WILL TEST YOU WITH COMANEX

Torch Computers are now giving away to purchaser of all Z80 disc packs the training package 'Comanex' by Sapphire. Full levels of documentation are included with this interactive management game which has been modelled on a typical manufacturing company. It sounds fun and should provide a realistic and perhaps exciting company simulation for firms and educational establishments.

Also recently introduced and to be included in the basic Torch micro hardware price is the Sapphire 'Mars' management, accounting, and reporting system. Torchmars makes full use of the Torch colour graphics and there will be comprehensive training support sessions on both Comanex and Mars. Details from: Sapphire Systems Ltd., 1-3 Park Avenue, Ilford, Essex IG1 4LU.

ON-SITE MAINTENANCE FOR BBC USERS

BBC owners can now make use of an on-site maintenance service provided by DDT Maintenance. It is available direct from the company or through Acorn dealers. A £50 annual contract entitles BBC users to a one day engineer response whenever a fault arises. For an additional £25 a replacement machine will be provided if the repair must be completed in DDT's own workshops. Details from: DDT Maintenance Ltd., 58-64 Northfield Road, Kings Norton, Birmingham B30 1JH.

PERFECT PLOTTING FROM PARFITT

Does anyone fancy using their BBC Micro to produce three-colour drawings, or perhaps to etch fine-lined pictures? Well the Parfitt plotter can do all this and more. The plotter has two motors which are controlled by signals from the computer. They drive a small carriage to an accuracy of 0.025cm above a flat bed. The plotter will accept paper up to A3 size and also other thicker sheet materials.

The computer can be programmed to use any combination of the three pens during operation so that three colours can be produced. They can be used to draw anything from geometric shapes and complex patterns to graphs and electronic circuit diagrams.

The carriage can also carry a

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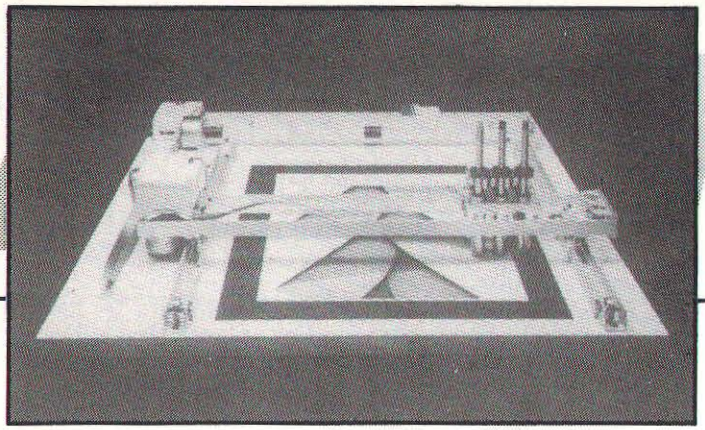


light sensor. The plotter then turns into a scanner which can scan a picture and display it on a television screen. The plotter certainly sets the imagination going. Teachers, technical designers, computer scientists and even artists may well find applications for this versatile addition to a BBC Microcomputer system. All the hardware is currently available and additional software is under development. Details from Parfitt Electronics Ltd., 6 View Road, London N6 4DA.

SERIOUS SOFTWARE – AND IT'S ON 3″

Gemini Marketing are repackaging some of their serious software for the domestic and business user. The new combination packs each contain five of the most popular Gemini applications and together provide for most of the accounting and management tasks in a medium sized business. There is also a small business pack for the Electron, and if you think the computer can help you around the home, a Home Pack. Prices range from £79.95 to £159.95 for the packs and represent considerable savings on the normal list price of individual programs.

Gemini are also among the latest software companies to make their programs available on the new 3″ disc format. Others are Clares, Bourne Educational and Beebug Soft.

THE TRINITRON – TAILOR MADE?

The new Sony KV1430 Trinitron colour television looks like the ideal buy for BBC and Electron users. The 14″ set allows the user to plug directly into the front of the television without disrupting the aerial for family viewing. The vertical styling gives an extra few inches in height and thus allows the computer to be set up directly in front of the set. The Trinitron is availble in white or grey for around £249.

VOGAN 8″ DFS

A new floppy disc operating system has been developed by Vogan Products for use with 8″ floppy disc drives. Acorn with cooperated on the project and the DFS is completely compatible with the standard Acorn DFS.

The system will work with most 8″ drives, including single and double sided density drives, and double density drives in a single density mode. The potential storage capability of 1.2 Mbytes is formatted using 77 tracks per surface will 15 256 byte sectors per track.

8-DFS allows two directories per disc surface with up to 62 user files per surface. Thus a system could support 248 active user files. The DFS is supplied with an EPROM containing both the disc operating system and the system utilities. There is also is manual and the all in cost comes out at £44.95 plus £1.50 postage and packing.

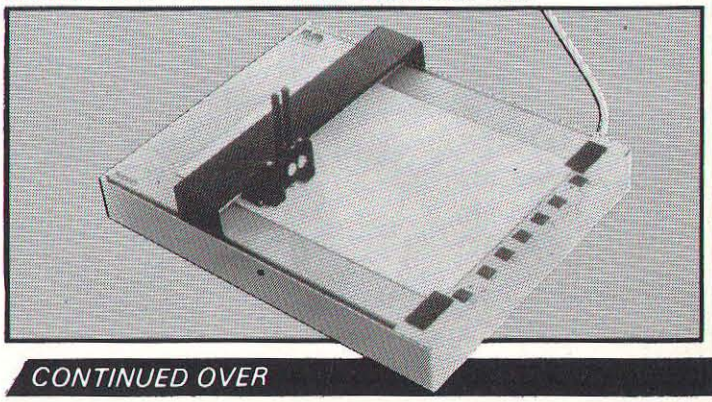
Further details from: Vogan Products, "The White House", 21 Grove Road, Hazlemere, Bucks HP15 7QY.

POWERFUL SOFTWARE FOR LINEAR GRAPHICS PLOTTER

Linear Graphics have launched a £450 plotter for the BBC which achieves 0.2mm accuracy over the plotting area and which is supported by some powerful software know as 'Interceptor'.

The Beaver plotter employs a new linear motor and optical feedback technology. It has a Centronics interface with RS232 optional. In all there are only four moving parts with no gears, pulley wheels or cords. It is virtually silent in operation. There is a universal pen holder and a number of switches allow for manual control of the plotter.

The Interceptor software is available at additional cost. It intercepts graphic commands for plotting and drawing form BASIC and routes them either to the screen or the plotter as required by the user. As a result, graphics program already written for the BBC, and there are many, can run with the Beaver with little of no modification. Details from: Linear Graphics Ltd., 34A Brook Road, Rayleigh Weir Industrial Estate SS6 7XN.



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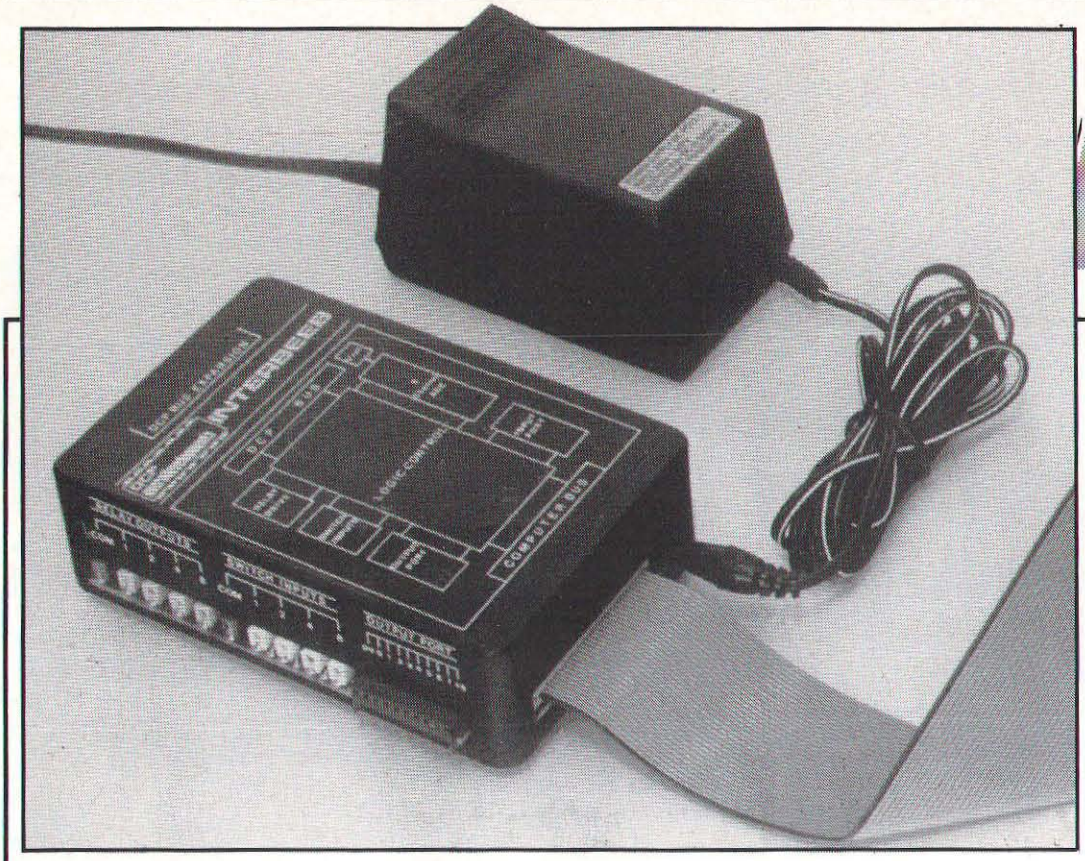
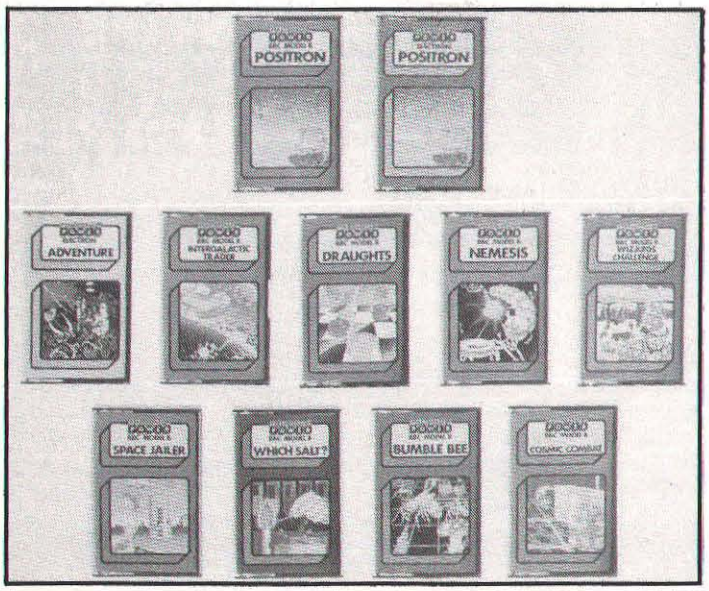


INTERBEEB IS WITH US

DCP microdevelopments has launched a set of products for the BBC. The main interest centres around Interbeeb, a complete electrical interfacing system for the computer. Specifically, the unit provides four relay outputs, four switch inputs, both input and output eight bit ports and an eight channel analogue digital converter. Additional packs of circuitry can be added to the rear of the unit on the DCP BUS connector. The pack comes complete with computer connecting cable and a low voltage power supply.

Suggested applications for the product include control experiments, heating systems, burglar alarms, model control, industrial monitoring and many others. There is also a set of simple control software and a comprehensive manual.

There are also fast A to D and D to A converters which can be added to the Interbeeb pack. They cost £19.95 each. Interbeeb itself costs £59.95 and is available from DCP microdevelopments Ltd., 2 Station Close, Lingwood, Norwich NR13 4AX.



NEW ELECTRON TITLES

There are already plenty of Electron games on the market. New from Micropower comes Position, a machine code game for the arcade fanatic. They also have Adventure now available for the Electron. Alligata's star Electron game is Bugblaster. They have also converted Lunar Rescue and Fruit Machine from their BBC games.

Romik Software have also come up with versions of their BBC arcade games Birds of Prey and Atom Smasher. And let's not forget the written word; the Orbit user group for the Electron have converted their parent magazine Beebug to Elbug and have packed it full of hints, tips and articles about the latest Acorn machine.

AIDS II

An enhanced version of the AIDS utility ROM is now available from Softsmith. The new features allow BASIC and Assembler programs to be better structured by use of the Line Renumber, Move and Merge commands. The program list Peruser allows the program listing to be scrolled in either direction, in lines or pages. The list formatter routine does a comprehensive tidying job on programs. Included in the package is a 24 pager manual. AIDS II costs £21.00 from Softsmith, 9 Back Green, Hersham, Surrey KT12 4HY.

EPSON BROCHURE FOR BBC

"Using your BBC Micro with Epson printers" is a long awaited publication from Epson. It is far from comprehensive but covers those areas likely to cause problems for owners of the BBC and its particular brand of BASIC. The manual summarises the most frequently used control sequences and explains how to set line feeds and send control characters to the printer. There is also a section covering the use of Epson printers in conjunction with Wordwise. The brochure is available free from Epson (UK) Ltd., Dorland House, 388 High Road, Wembley, Middx, by sending a SAE or telephoning Freephone Epson.

A CUP OF TEA WITH MICROSIGHT

Digithurst's Microeye interface, the heart of the BBC vision system now has some new software packages included as well as the standard MicroSight program. BBC Hi Res displays a 256 × 256 image in Mode 0 thus taking advantage of the 256 × 300 resolution of the interface. Images can be stored on disc or printed out on a dot matrix printer.

The new Photo Graphics package displays the 256 × 256 image in Mode 2 and uses colours on a monochrome display to represent greyscales. The

WS News

MicroSight system including software is available for £495 plus VAT. Digithurst are at Leaden Hill, Orwell, Royston, Herts. SG8 5QH.

INCREASED SENSITIVITY FOR YOUR BBC

In any situation where the Qwerty keyboard forms a barrier between the user and the computer, the Concept keyboard from Star Microterminals Ltd could well be the answer.

The pad takes interchangeable A4-size overlays which define the number, shape, size, colour, position and legending of the keys. Each program can use a separate overlay. The keys can be made large enough to allow operation by visually or physically handicapped pupils.

The keyboard has an eight by sixteen matrix of touch-sensitive areas, each producing a unique seven bit ASCII code which the programmer defines as required. There is also a bleeper with on/off control and two additional user-dedicated touch pads.

For further information, get in touch with Lesley Stubley, Star Microterminals Ltd, 22 Hyde Cwnbran, Gwent NP44 3YP.

PROCYON INTERFACE FOR THE BBC

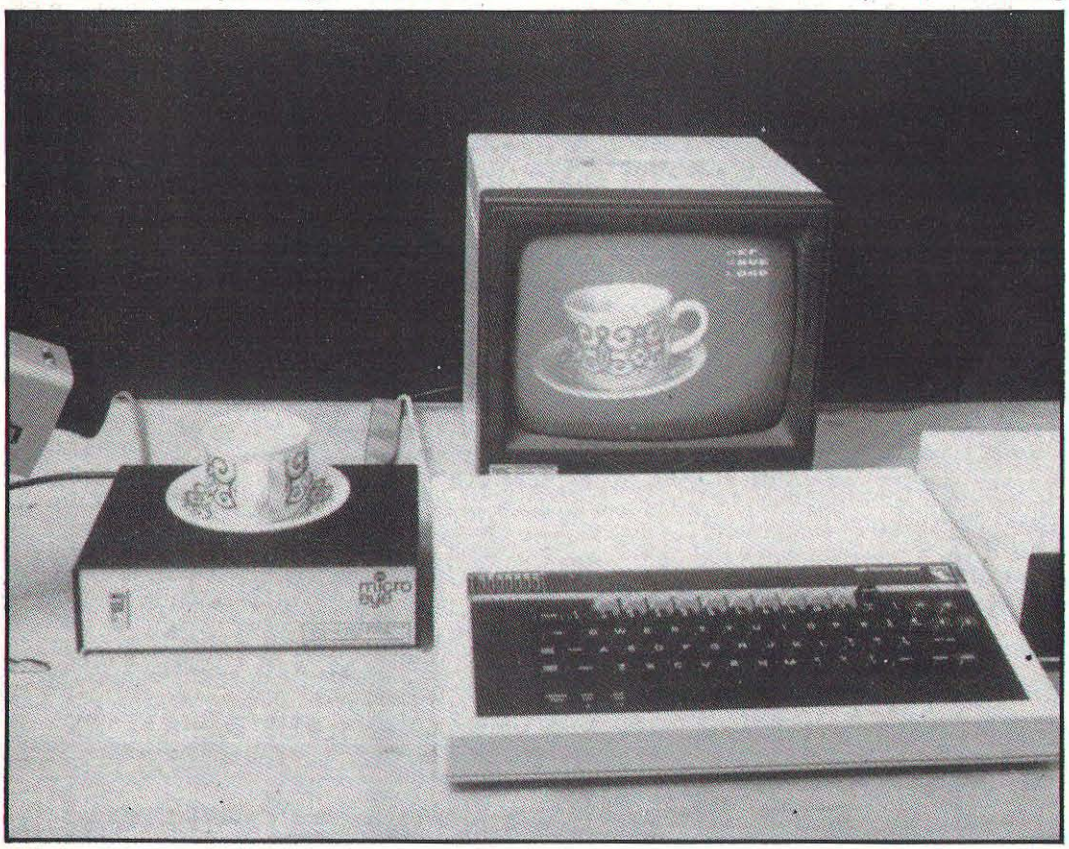
Cambridge Systems Technology has not got a fully operational IEEE interface for the BBC. The CST 'Procyon' is a compact device which allows users to communicate with the wide range of instruments operating to the IEEE-488. The Procyon is particularly valuable in educational or scientific establishments, where a BBC micro needs to interface with high quality plotters and printers, frequency counters, voltmeters or disc drives, but is equally useful to connect the "Beeb" to CBM equipment via a specially written Commodore filing system. It responds to any high level language including LISP, FORTRAN, FORTH, BASIC or APL.

The Procyon is supplied with an 8K EPROM which fits a vacant sideways ROM socket in the BBC micro and supplies a highly efficient IEEE filing system. The system can cope with up to 16 connected devices, accepting standard operating system file commands as well as special instructions or user-defined options.

At up to 70K bytes of information per second, the PROCYON offers very rapid data transfer between devices. It is helpful and virtually fool-proof with extensive user advice facilities, error checking and visual indicationa or operating status.

A straightforward but comprehensive manual is supplied with the system, containing tutorials for beginners and advice on maximising the Procyon's effectiveness.

Further information from: Cambridge Systems Technology, 30 Regent Street, Cambridge CB2 1DB. Tel: 0223 323302.



PROGRAM PRINTOUT SERVICE SPECIAL OFFER FOR A&B READERS

Program Printout Services are now offering a comprehensive range of print facilities to BBC owners who haven't as yet taken the plunge into buying their own dot-matrix or daisywheel. Various formats are catered for including double line spacing, LISTO7 and a unique sectionalised format designed by PPS themselves. Also available are printouts of Wordwise files, screen dumps, disassembled machine code programs and various labelling duties.

Prices range upwards from six pence per block. Further details from: Mr M. Small, 8 Cherry Tree Road, Chinnor, Oxfordshire OX9 4QY.

As a special offer to be readers of A&B Computing, Program Printout Services are prepared to give 10% discount for any first order. All you have to do is mention our name with your initial enquiry for the PPS leaflet which details the services available.

A STACK OF NEW TITLES FOR YOUR LIGHPEN

Titles like Seek and Destroy, Shuffler and lost in the Labyrinth are among the latest nine pieces of software released by Stack Computer Services for their BBC lightpen. Others sound a mite more ordinary, Life, Simon, Othello and Draughts included.

Stack Computer Services Ltd, 290-298 Derby Road, Bootle, Liverpool L20 8LN. Tel: 051 933 5511.

Cellars

Keith Miles

Up and down ladders. Drive yourself crazy in this colourful arcade game.

Cellars is a variation on a well-known arcade game.

Your man is pursued up and down ladders and through tunnels in search of gold. In addition to three monsters that are pursuing him there are immobile monsters that periodically jump to new locations. As you proceed to higher levels the number of these later monsters increases.

The particular features of this game that make it different from most games previously written in BASIC is that it makes extensive use of EXCLUSIVE OR (EOR) colour printing and multicolour characters.

When printing at the Graphics Cursor (VDU 5), it is possible to superimpose defined (or any other) characters on top of each other. Using different colours for the different features of the character to be created, the character is assembled by moving the cursor to the required location and successively selecting the foreground colour of the part of the character to be printed, printing it and moving the cursor back over the character.

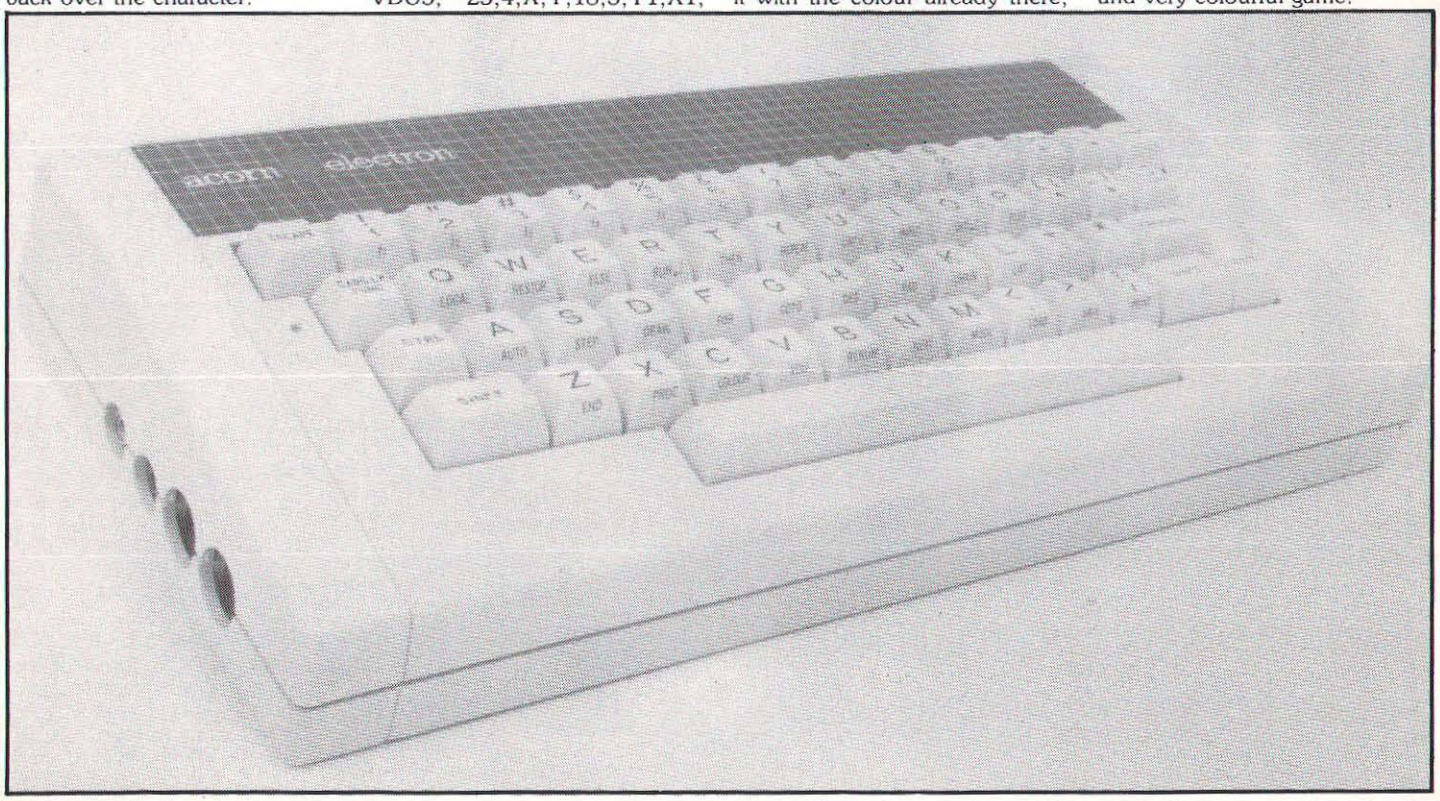
In BASIC this would take the form – VDU5 : MOVE X,Y : GCOL3,Y1 : PRINT CHRS$(X1) : VDU8 : GCOL3,Y2 : PRINT CHR$(X2) etc where W,Y are the desired screen co-ordinates, Y1 the colour of character X1 and Y2 the colour of character X2. The VDU commands cause printing to take place at the graphics cursor and move the cursor one space left respectively. The man, monsters and levels in the game are constructed on this way. These commands can all be replaced and strung together as VDU commands e.g. MOVE is VDU25,4,X;Y; GCOL is VDU18,3,Y1 and PRINT is simply VDUX2 e.g. the above line of BASIC would now read VDU5, 25,4,X;Y;18,3,Y1,X1, 8,18,3,Y2,X2. Not only is this shorter (if less readable) but it executes faster. This is very important for the more complicated a character is the longer it takes to print and the slower movement will be.

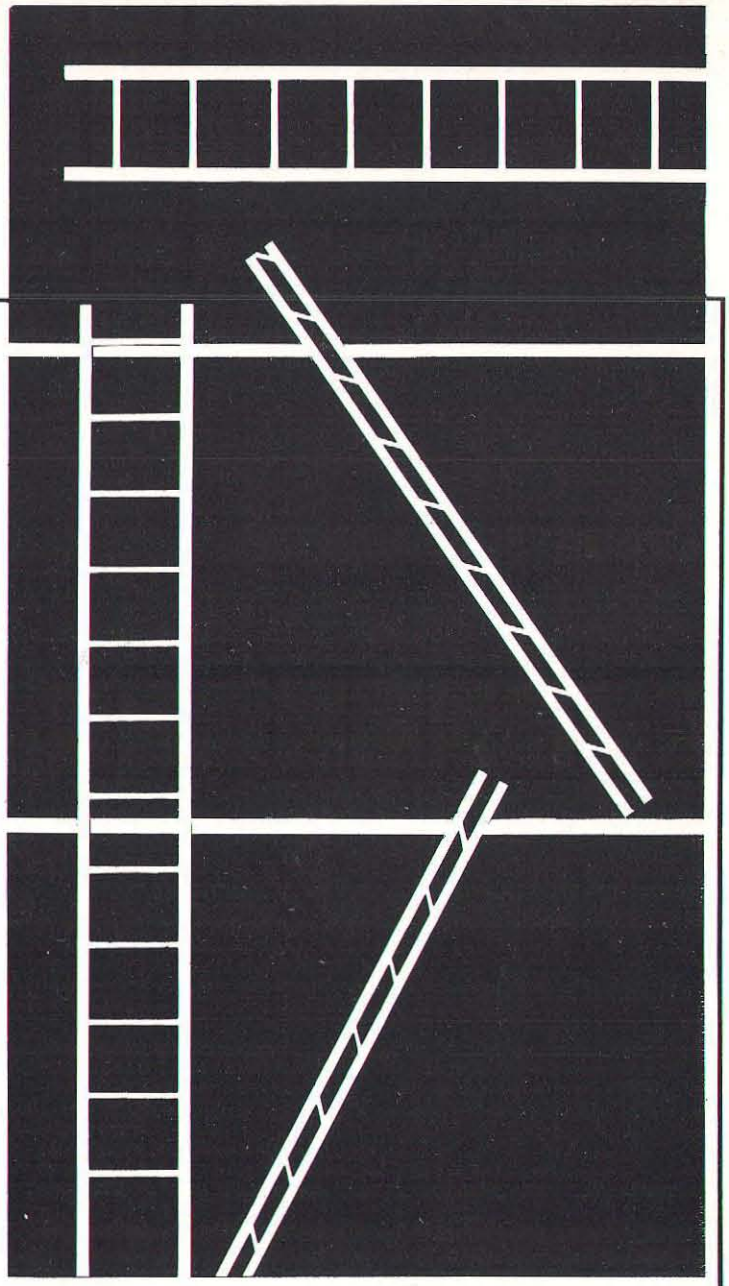
LOGICAL MOVEMENT

EXCLUSIVE OR (EOR) printing is important when coloured characters are to be moved. Refer to the User Guide for a detailed explanation, but when printing graphics characters colour is chosen with GCOL x,y where function x determines how colour y will be printed. x can have five values 0,1,2,3,4 which respectively print the colour, OR it with the colour already there, AND it the colour already there, EOR it etc and INVERT it etc. EOR (3) is used because it is possible to predict the outcome of function and by careful manipulation of the colour palette using VDU 19 to enable characters to move over other characters. For example RED (colour 1) EORed with BLUE (colour 4) gives MAGENTA (colour 5) if a red character is printed on top of a blue character, but if colour 5 is redefined to be red (VDU19,5,1,0,0,0) that part of the red character over the blue character will show red NOT magenta. The EOR values needed are mathematically derived but can be easily found by using the BBC's own EOR function – type 1 EOR 4 to check the above example.

The game itself consists of a series of linked procedures the names of which are largely self explanatory.

I hope that you will agree that despite the drawbacks of being written in basic, it is possible to write a reasonably playable and very colourful game.





PROGRAM LISTING

```
  20 DIMmx%(2),my%(2),dir%(2),u%(2),d%(2),ud%(2),MX%(5
),MY%(5),A$(10,1)
  30 ENVELOPE3,129,2,4,6,28,14,7,0,0,0,-80,80,80
  40 MODE2
  50 PROCcolour
  60 PROCcharacters
  70 PROCscore
  80 LVL%=1:gld%=0:PROCtitle:CLS
  90 CLG:PROCscreen
 100 IFLVL%>5 LVL%=5
 110 PROCinit
 120 REPEAT
 130 *FX21,0
 140 LVD%=FNPT(man%-20,level%-64):lvd%=FNPT(man%+20,le
vel%-64):lvu%=FNPT(man%,level%+12)
 150 IFINKEY(-26) DIR%=-64
 160 IFINKEY(-122) DIR%=64
 170 IFINKEY(-58)ANDlvu%<>4ANDlvu%<>-1 LEVEL%=32:GOTO2
00
 180 IFINKEY(-42)ANDlvd%<>4 LEVEL%=-32:GOTO200
 190 IFlevel% MOD160=64 LEVEL%=0
 200 IFman%<=0 DIR%=64
 210 IFman%>=1216 DIR%=-64
 220 IFLEVEL%<>0 DIR%=0
 230 man%=man%+DIR%:level%=level%+LEVEL%
 240 PROCman(man%-DIR%,level%-LEVEL%):PROCman(man%,lev
el%)
 250 gd%=FNPT(man%+48,level%-44):IFgd%=9THEN300
 260 FORI%=0TO2:PROCmonsterdir:SOUND&10,-8,2,2:NEXT
 270 IFRND(1)>.8 PROCmovemonster:SOUND&10,-8,2,2
 280 gd%=FNPT(man%+48,level%-44)
 290 IFgd%=3 PROCfoundgold
 300 UNTIL GD%=10OR gd%=9OR gd%=15
 310 IFGD%=10 LVL%=LVL%+1:GOTO90
 320 PROCend
 330 VDU4
 340 PROChiscore:GOTO80
 350 DEFPROCscreen
 360 VDU5
 370 FORG%=960TO160STEP-160
 380 FORI%=G%TOG%-64STEP-32:MOVE0,I%:FORJ%=0TO19:VDU18
,0,4,224:NEXT:NEXT:NEXT:REM Levels
 390 VDU4
 400 FORB%=1TO2
 410 FORI%=0TO20STEP5:A%=RND(18):FORJ%=0TO6:VDU17,3,31
,A%,I%+J%,226:NEXT:NEXT:REM Ladders
 420 NEXT
 430 COLOUR1:PRINTTAB(0,30)"GOLD BAGS ";gld%;
 440 VDU5
 450 ENDPROC
 460 DEFPROCinit
 470 man%=64:level%=1024:lvd%=0:lvu%=0:GD%=0:DIR%=64:L
EVEL%=0
 480 PROCman(man%,level%)
 490 FORI%=0TO2:mx%(I%)=RND(19)*64:my%(I%)=RND(4)*160+
224:dir%(I%)=64:u%(I%)=0:d%(I%)=0:ud%(I%)=0:PROCmonster
(mx%(I%),my%(I%),15,9):NEXT
 500 FORI%=0TO LVL%:PROCstillmonster:NEXT
 510 FORI%=0TO9:PROCgold:NEXT
 520 ENDPROC
 530 DEFPROCgold
 540 X%=RND(19)*64:Y%=RND(6)*160+32
 550 gd%=FNPT(X%+48,Y%-12):IFgd%<>0THEN540
 560 VDU25,4,X%;Y%;18,3,3,245
 570 ENDPROC
 580 DEFPROCfoundgold
 590 VDU25,4,man%;level%-32;18,3,2,245
 600 GD%=GD%+1:gld%=gld%+1:SOUND&13,3,50,10
 610 VDU4:PRINTTAB(10,30);gld%;:VDU5
 620 ENDPROC
 630 DEFPROCman(x%,y%)
 640 VDU25,4,x%;y%;18,3,1,227,8,18,3,5,228,8,18,3,7,22
9,8,18,3,9,230,25,4,x%;y%-32;231,8,18,3,15,233,8,18,3,5
,232
 650 ENDPROC
 660 DEFPROCmonsterdir
 670 IFu%(I%)<>0AND u%(I%)<>6 PROCupmonster:GOTO740
 680 IFd%(I%)<>0AND d%(I%)<>6 PROCdownmonster:GOTO740
 690 msd%=FNPT(mx%(I%)+20,my%(I%)-64):msu%=FNPT(mx%(I%
),my%(I%)+12)
 700 IFmsd%<>4AND RND(3)=1 d%(I%)=0:PROCdownmonster:GO
TO750
 710 IFmsu%<>4AND msu%<>-1AND RND(3)=1 u%(I%)=0:PROCup
monster:GOTO750
 720 IFmx%(I%)<=64 dir%(I%)=64
 730 IFmx%(I%)>=1216 dir%(I%)=-64
 740 mx%(I%)=mx%(I%)+dir%(I%)
 750 my%(I%)=my%(I%)+ud%(I%)
 760 PROCmonster(mx%(I%)-dir%(I%),my%(I%)-ud%(I%),15,9
):PROCmonster(mx%(I%),my%(I%),15,9)
 770 ENDPROC
 780 DEFPROCupmonster
 790 u%(I%)=u%(I%)+1:ud%(I%)=32:dir%(I%)=0
 800 IFu%(I%)=6 u%(I%)=0:ud%(I%)=0:dir%(I%)=64:IFRND(2
)=1 dir%(I%)=-64
 810 ENDPROC
 820 DEFPROCdownmonster
 830 d%(I%)=d%(I%)+1:ud%(I%)=-32:dir%(I%)=0
 840 IFd%(I%)=6 d%(I%)=0:ud%(I%)=0:dir%(I%)=-64:IFRND(
2)=1 dir%(I%)=64
```

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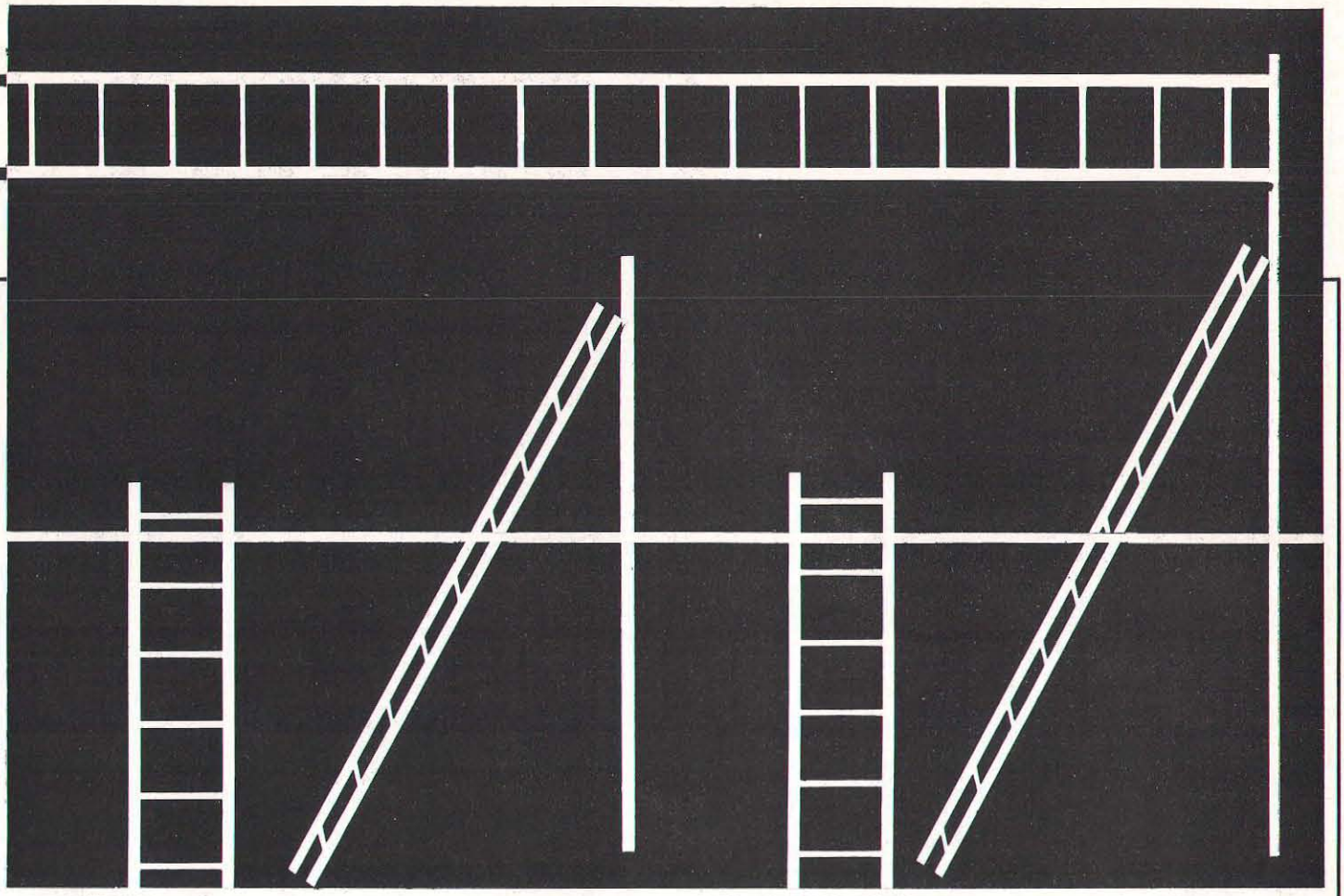

```
  850 ENDPROC
  860 DEFPROCmonster(mx%,my%,A,B)
  870 VDU25,4,mx%;my%;18,3,A,255,8,18,3,7,253,8,18,3,0,
254,8,18,3,B,252,25,4,mx%;my%-32;250
  880 ENDPROC
  890 DEFPROCstillmonster
  900 MX%(I%)=RND(19)*64:MY%(I%)=RND(5)*160+64
  910 gd%=FNPT(MX%(I%)+48,MY%(I%)-44):IFgd%<>0THEN900
  920 PROCmonster(MX%(I%),MY%(I%),9,15)
  930 ENDPROC
  940 DEFPROCmovemonster
  950 I%=RND(LVL%+1)-1:mx%=MX%(I%):my%=MY%(I%)
  960 MX%(I%)=RND(19)*64:MY%(I%)=RND(5)*160+64
  970 po%=FNPT(MX%(I%)+48,MY%(I%)-44):IFpo%=10Rpo%=30Rp
o%=15THEN960
  980 PROCmonster(mx%,my%,9,15):PROCmonster(MX%(I%),MY%
(I%),9,15)
  990 ENDPROC
 1000 DEFPROCend
 1010 FORI%=1TO10:SOUND&10,-12,6,10:FORJ%=1TO10:VDU19,0
,RND(6);0;:FORI=1TO50:NEXT,,
 1020 VDU19,0,0;0;
 1030 ENDPROC
 1040 DEFPROChiscore
 1050 CLS:*FX21,0
 1060 IFgld%>VAL(A$(1,0)) PRINT"Enter your name.":A$(1,
0)=STR$(gld%):PRINT'A$(1,0)"....";:INPUTA$(1,1)
 1070 REPEAT:swap%=0
 1080 I%=0:REPEATI%=I%+1
 1090 IFVAL(A$(I%,0))>VAL(A$(I%+1,0)) B$=A$(I%+1,0):A$(
I%+1,0)=A$(I%,0):A$(I%,0)=B$:B$=A$(I%+1,1):A$(I%+1,1)=A
$(I%,1):A$(I%,1)=B$:swap%=1
 1100 UNTILI%=9
 1110 UNTILswap%=0
 1120 CLS:COLOUR4:PRINTTAB(3)"HALL OF FAME"
 1130 COLOUR3:FORI%=10TO1STEP-1:A%=LEN(A$(I%,0)):PRINT'
TAB(3-A%)A$(I%,0)"...."A$(I%,1):NEXT
 1140 COLOUR4:PRINT'TAB(3)"PRESS <SPACE>";:A$=GET$
 1150 ENDPROC
 1160 DEFPROCtitle
 1170 VDU12,17,9:PRINTTAB(6,1)"CELLARS."
 1180  COLOUR3:PRINT''"Pursued by monsters"'"your man
is chased"'"up and down ladders"'" and along tunnels"
'" in search of gold."
 1190 COLOUR1:PRINT'"  His movement is"'"controlled u
sing the"'"   cursor keys."
 1200 COLOUR5:PRINT'"    GOOD LUCK."
 1210 COLOUR9:PRINT'"   Press <SPACE>"'"    to play o
r"'"  <RETURN> to end."
 1220 A=GET
 1230 IFA=32 ENDPROC
 1240 IFA=13 CLS:VDU22,7:END
 1250 GOTO1220
 1260 DEFPROCcolour
 1270 VDU19,15,1;0;19,14,1;0;19,13,1;0;19,12,1;0;:REM 1
5,14,13,12 red
 1280 VDU19,2,4;0;:REM 2 blue
 1290 VDU19,9,2;0;19,10,2;0;19,8,2;0;19,11,2;0;:REM 9,1
0,8,11 green
 1300 VDU19,6,5;0;:REM 6 magenta
 1310 ENDPROC
 1320 DEFPROCscore
 1330 FORI%=1TO10:A$(I%,0)=STR$(I%*5):A$(I%,1)="Monster
-"+STR$(I%):NEXT
 1340 ENDPROC
 1350 DEFPROCcharacters
 1360 VDU23,224,238,238,0,119,119,0,238,238,23,226,129,
129,129,129,255,129,129,129:REM Bricks, ladder
 1370 VDU23,227,56,124,130,0,0,0,0,0,23,228,0,0,84,124,
56,0,0,0,23,229,0,0,40,0,0,0,0,0:REM Hair, face, eyes
 1380 VDU23,230,0,0,0,0,0,254,254,186,23,231,186,0,0,0,
0,0,0,0,23,232,0,130,0,0,0,0,0,0,23,233,0,56,56,40,40,4
0,40,108:REM U.body, L.body, hands, legs
 1390 VDU23,245,24,36,110,66,110,66,60,24:REM Gold
 1400 VDU23,250,255,255,255,255,126,36,36,102:REM L.bod
y
 1410 VDU23,252,0,0,0,0,126,255,153,153,23,253,0,0,0,0,
0,0,68,102,23,254,0,0,0,0,0,0,34,0,23,255,0,0,231,36,0,
0,0,0:REM U.body, eyes, pupils, horns
 1420 ENDPROC
 1430 REM MOVE - VDU25,4,X;Y; - GCOL - VDU18,X,Y - [ VD
U8
 1440 DEFFNPT(d%,e%)
 1450 =POINT(d%,e%-1)
```

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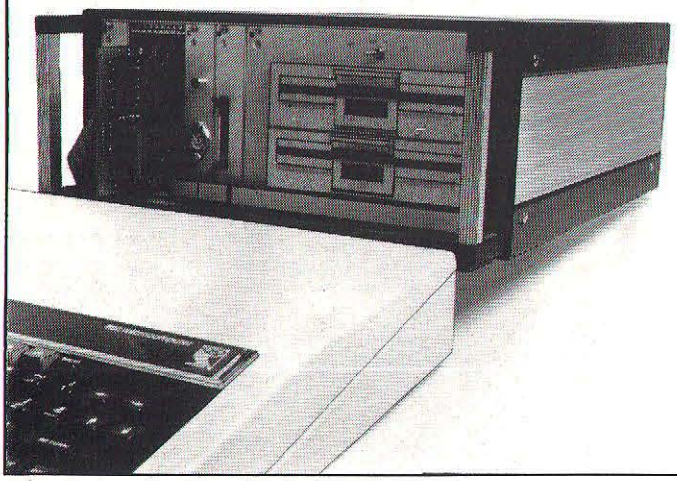

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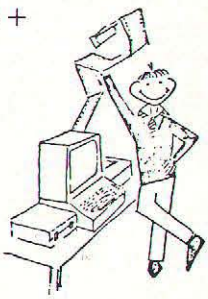

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3. TV's Roland

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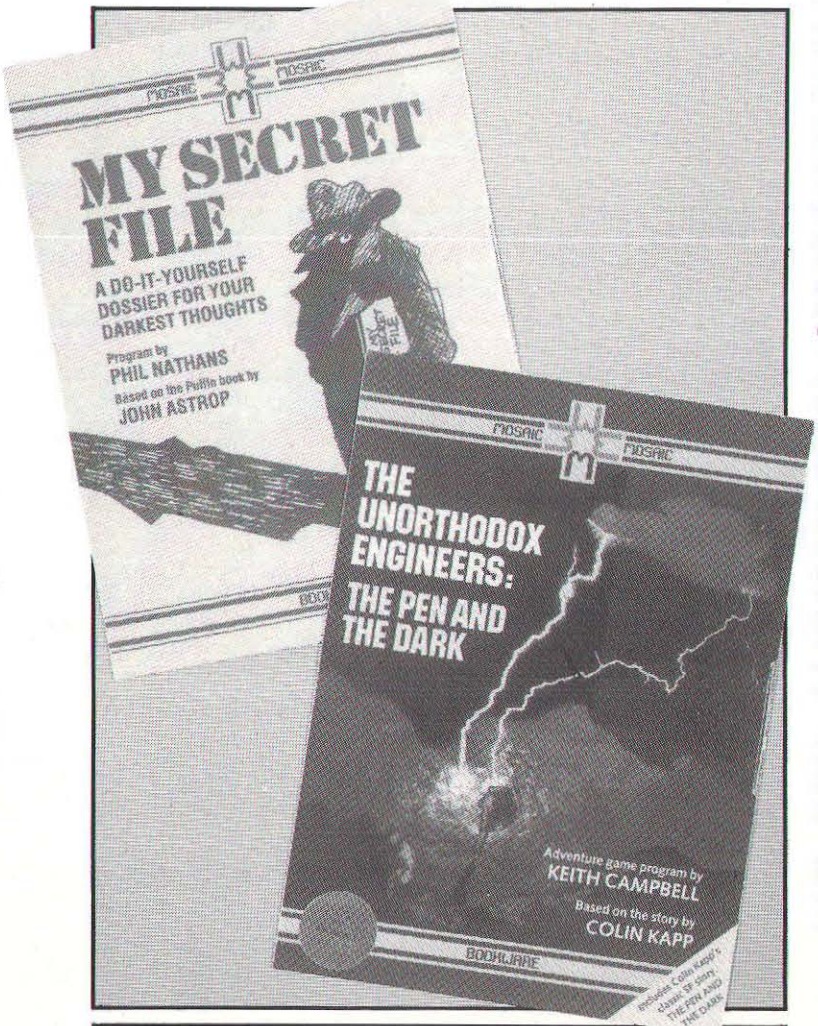

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Advanced Graphics

Bruce Smith

Let's get logical as we dip our brushes into the colour palettes of the BBC Micro and Electron.

In this issue's article we shall be having a close look at the way colours are implemented and used on the BBC Micro. To do this we must first understand the two different categories of colour termed 'logical' and physical; and the relationship between them that is referred to as the palette.

Figure 1 shows the default colours associated with each of the graphics modes. Each colour has a logical colour number associated with it. This is the most important one and the numbering of the logical colours is directly associated with the number of colours available in that mode. Thus in MODE 5 four colours are possible at any one time and these are numbered logically as 0,1,2 and 3. Similarly in two colour modes only logical colours 1 and 2 are possible. In MODE 2 however, all 16 of the colours are possible and these are numbered 0 to 15.

PHYSICAL AND LOGICAL

The physical number associated with a colour does not alter thus physical colour 5 will always be magenta and can never be anything else. The logical value of a colour can change though. Whenever a mode change is executed the logical colours associated with that mode are placed onto the palette, any previous colours are 'washed' away. Thus executing MODE 5 will place the colours black, red, yellow and white onto the palette. This does not restrict us to using only these colours in MODE 5 though other colours can be used, the mode only determines the total choice of colours present at any one time. Using a VDU 10 statement it is possible to replace any of the logical colours with a new physical colour. If you think of the palette as being like a paint box the VDU 19 command simply takes out the 'old' physical paint pot from its current logical position and replaces it with a 'new' physical colour. The colour changes but its position in the paint box does not. The syntax of the palette changing command is:

TWO COLOUR MODES 0 and 3

logical	colour	physical
0	black	0
1	white	7

FOUR COLOUR MODES 1 and 5

logical	colour	physical
0	black	0
1	red	1
2	yellow	3
3	white	7

SIXTEEN COLOUR MODE 2

logical	colour	physical
0	black	0
1	red	1
2	green	2
3	yellow	3
4	blue	4
5	magenta	5
6	cyan	6
7	white	7
8	*black-white	8
9	*red-cyan	9
10	*green-magenta	10
11	*yellow-blue	11
12	*blue-yellow	12
13	*magenta-green	13
14	*cyan-green	14
15	*white-black	15

FIGURE 1 THE PALETTE

*denotes flashing

Fig. 1.

VDU 19,L,P;0;
where L is the logical colour to be replaced by P the physical colour; note the use of the two semicolons after the last two digits as opposed to commas.

The following example gives a very good indication to the power of this colour switching facility.

```
10 MODE 5
20 A=GET
30 VDU 19,0,1;0;
40 A=GET
50 VDU 19,0,3;0;
60 A=GET
70 VDU 19,0,7;0;
```

In MODE 5 the logical colour 0 is black, which is the normal background colour of the screen. Pressing a key will allow line 30 to replace logical colour 0 with physical colour red, black will become red. The net effect is that the screen instantaneously changes from black to red. Lines 50 and 70 behave in a similar way subsequently replacing red with yellow and then white at the instant a key is pressed.

The availability of an instant colour change facility opens up a number of interesting and exciting possibilities. For example, by setting a logical colour to the background colour and then drawing an object in this colour, it can be made to appear immediately by reprogramming the palette. This principle can be used to produce animation as we shall see at a late date.

It is possible to redefine any or all of the logical colours in a particular MODE. If we wish to use magneta, green, red and yellow in MODE 5 rather than the normal black, red, yellow and white we could use:

```
10 MODE 5
20 VDU 19,0,2;0; : REM
logical 0 is physical 2
30 VDU 19,3,4;0; : REM
logical3 is physical 4
```

line 20 changes black (0) to green (physical 2) and line 30, white (3) becomes blue (physical 4).

GRAPHIC COLOUR

BBC BASIC is provided with a very powerful command that allows colours not only to be selected but also determines the way they are written to the graphics screen. The command is GCOL short for Graphics COLour, it takes theform:
GCOL form%, C%
where form% determines the action of the command and C% the logical colour to be processed by it.

The range of values that may be associated with C% are 0 to

GCOL 0, C%	Plot colour% onto the screen ignoring colour already present i.e. paste it on top
GCOL 1, C%	Logically OR colour% with logical colour present at PLOT position and plot resultant colour
GCOL 2, C%	Logically AND colour% with logical colour present at PLOT position and plot resultant colour
GCOL 3, C%	Logically EOR colour% with logical colour present at PLOT position and plot resultant colour
GCOL 4, C%	Invert (perform logical NOT) the logical colour present at PLOT position ignorring value of colour%

Fig. 2.

15 for the foreground and these relate directly to the logical colours in the chosen MODE. Thus in MODE 5 executing GCOL 0,1 would cause all subsequent lines to be drawn in red. The background colour can also be influenced by the GCOL command. To set the background to a certain colour add 128 to the logical colour chosen. For example to clear the MODE 5 screen with red RUN the following:

```
10 MODE 5
20 GCOL 0,120 : REM 128+1
is background + red
30 CLG
```

We have introduced a new command in line 30 CLG, CLear Graphics, as its name suggests it clears the current graphics screen and in this instance clears it with red. Changing line 20 to GCOL 0,130 will clear the screen to yellow on RUNning and so forth.

MODES OF ACTION

Figure 2 lists the various modes of action possible with GCOL depending on the value of form%. In the examples above we have assigned 0 to form parameter. This allows lines of any colour to be drawn directly over the top of anything on the screen. The remaining three parameters perform different functions depending on the logical relationships between the logical colour, C%, and the logical colour present on the screen at the particular spot being DRAWn or PLOTed to. Figure 3 lists the binary representations of the numebrs 0 to 15. This may be of help as we investigate each mode of action.

GCOL 1,C% — relies on the logical OR operation which has four simple rules:

```
0 OR 0 = 0
1 OR 0 = 1
0 OR 1 = 1
1 OR 1 = 1
```

the resultant bit will only be set if either or both the test bits are set. The following program can be used to demonstrate the effect.

```
10 MODE 5
20 GCOL 0,1
30 PLOT 5,1000,1000
40 MOVE 0,0
50 A=GET
60 GCOL 1,2
70 PLOT 5,1000,1000
```

RUNning this will cause a red line to be drawn diagonally across the MODE 5 screen. On touching a key the GCOL parameters are redefined (line 60) and a yellow line is drawn on top of the original one, however, it produces a white line. We can show how this came about by logically ORing the logical values of each colour;

number	binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

Binary representation of 0 to 15.

Fig. 3.

```
red = 0001
yellow = 0010
OR = 0011 = 3 which is white
```

We can show conclusively that it is logical colour that is processed and not the physical colour by altering the palette. Add the following line:

```
25 VDU 19,1,4;0;
```

Now logical colour 1 (red) is redefined as physical colour 4 (blue). Next time the program is run a a blue line is drawn, then overlaid by a yellow one resulting in a white line!

GCOL 2,C% invokes the logical AND operation. In this mode of operation the bits in the resultant colour will only be set of the bits in the colours under test are both 1 such that:

```
0 AND 0 = 0
1 AND 0 = 0
0 AND 1 = 0
1 AND 1 = 1
```

Delete line 25 and reenter line 70 as:

```
70 GCOL 2,2
```

On RUNning the red line is drawn across the screen and then erased from it. Well thats not strictly true, its still there! What happened in this instance was that the logical AND of a yellow line drawn over a red one produced a black one which just happens to be the background colour!

```
red = 0001
yellow = 0010
AND = 0000 = 0
```

the logical colour 0 is black.

GCOL 3,C% uses the Exclusive OR operation between the two logical colours to determine the colour of the line. The EOR operation will ony result in a 1 if the bits under test are dissimilar, thus:

```
0 EOR 0 = 0
1 EOR 0 = 1
0 EOR 1 = 1
1 EOR 1 = 0
```

Changing line 70 to:

```
70 GCOL 3,2
```

will result in a white line being drawn because:

```
red = 0001
yellow = 0010
EOR = 0011 = 3 which is white
```

Finally GCOL 4,C% does not take into consideration C% at all! What the statement does do is to invert or perform a logical NOT of the logical colour at the PLOT position. Inverting a number is performed by changing all 1's into 0's and all the 0's to 1's, 0101 will therefore invert to 1010. Altering line 70 once again to:

70 GCOL 4,2 will plot the tired red line and invert it onto a flashing cyan-green one.

```
red = 0001
INVERT = 1100 = 14 or
flashing cyan-green.
```

Program 1 shows the type of effect that can be produced using the GCOL statement with parameter values of 1,2, and 3 to draw four triangles over one another.

LETS GET PHYSICAL

Now that we have taken an introductory look at logical colours and there implementation we can switch our attention to the subject of physical colours. The term physical is itself a clue to the function of this type of colour. As you may well have guessed the physical colour value associated with each colour is the value the Beeb use to store into screen memory to produce the desired colour. However, its not quite

CONTINUED OVER

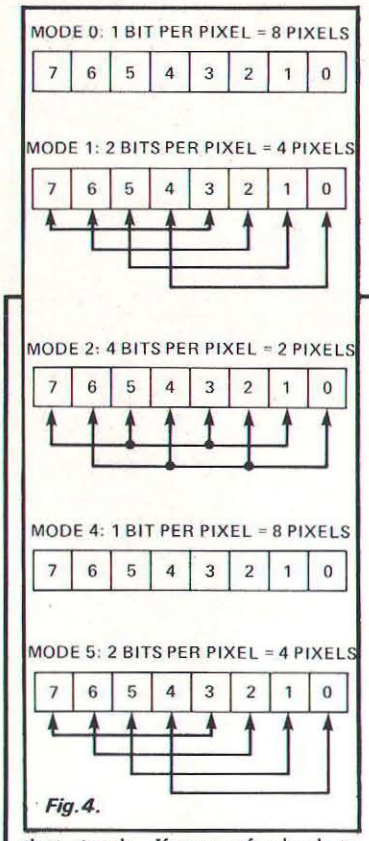

Fig.4.

that simple. If you refer back to last issue's article you'll remember that the Screen memory map in the graphics modes is constructed in columns of 8 bytes that are built up one on top of the other 'across' and down the screen. Figure 4 shows how the individual bytes of screen memory are constructed for each graphics mode. As we have been dealing with MODE 5 throughout our examples lets examine the byte associated with that mode. It consists of 4 pixels constructed as 2 bits per pixel (2 bits * 4 pixels = 8 bits or 1 byte), note though that the bits associated with each pixel are not adjacent but offset from one another. The bit pixel relationships in MODE 5 are therefore:

Pixel 4 : 7 and 3
Pixel 3 : 6 and 2
Pixel 2 : 5 and 1
Pixel 1 : 4 and 0

We can create the equivalent of GCOL 0,129 (clear screen with red) without using GCOL by poking each pixel in the whole of memory associated with MODE 5 with the physical colour value. Looking at Figure 1 we see this is 1 or 01 binary. Figure 5 shows how each bit needs to be arranged in each byte, converting this bit pattern, 00001111, into decimal we obtain 5, which is the colour value to produce red in MODE 5.

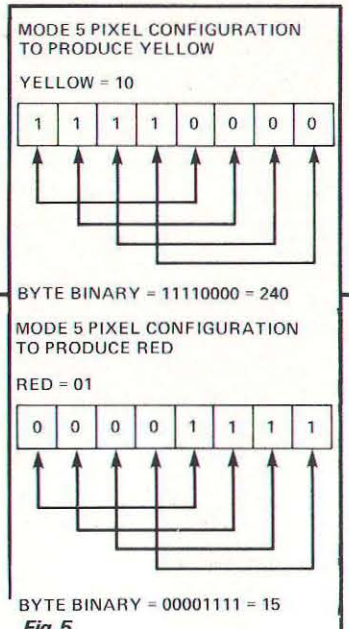

Fig.5.

```
10 MODE 5
20 FOR byte% = HIMEM + 1
TO &A400
30 ?byte% = 15
40 NEXT
```

Similarly to clear the screen to yellow we can replace the 15 in line 30 with 240. Figure 6 shows how this value was obtained.

By poking various values onto screen memory it is also possible to create new 'colours' and striped effects. For example alternating the pixels within a byte with the physical codes for red and yellow it is possible to produce orange as Program 1 demonstrates. It must be pointed out though that this can only be used to good effect in MODE 0 as the pixels are packed together due to the increased resolution. Model A owners can try altering line 10 to read MODE 4 Poking successive screen memory locations in this way is somewhat slow so you'll be pleased to learn that these new combination colours and stripes can be implemented using GCOL and PLOT. In this instance the first parameter of the GCOL statement gives the 'new' colour information. Program 2 draws a triangle in red, then yellow and finally red-yellow stripes; substituting MODE0 in line 10 will produce an orange triangle. Lines 10 to 65 are self-explanatory. Line 70 is the one that is of real interest. The value 119 is &77 in hex which was used in Program 3 to clear the screen to orange. Therefore to PLOT a line in a 'new' colour construct the binary as described above and use it as the first parameter in the GCOL statement.

PROGRAM LISTING 1

```
LIST
   10 MODE5
   20 REM ** reset palette **
   30 VDU19,0,0;0;
   40 VDU19,1,2;0;
   50 VDU19,2,1;0;
   60 VDU19,3,2;0;
   70 REM ** logically OR triangle **
   80 GCOL1,1
   90 PROC_TRIANGLE(200,800,800,1000)
  100 GCOL1,2
  110 PROC_TRIANGLE(100,1200,900,800)
  120 REM ** logically AND triangle **
  130 GCOL2,2
  140 PROC_TRIANGLE(400,600,700,750)
  150 REM ** logical EOR triangle **
  160 GCOL3,2
  170 PROC_TRIANGLE(150,300,400,500)
  180 PRINT"GCOL EXAMPLES"
  190 END
  200 ************************
  210 DEF PROC_TRIANGLE(A,B,C,D)
  220 MOVE A,100
  230 MOVE B,100
  240 PLOT 85,C,D
  250 ENDPROC
  260 ************************
```

PROGRAM LISTING 2

```
  5 REM ** orange using red and yellow **
 10 MODE0
 15 REM ** yellow  11111111 **
 20 FOR byte%=HIMEM+1 TO &7F3F
 30  ?byte%=&FF
 40 NEXT
 45 REM ** red     01010101 **
 50 FOR byte%=HIMEM+1 TO &7F3F
 60  ?byte%=&55
 70 NEXT
 75 REM ** orange  01110111 **
 80 FOR byte%=HIMEM+1 TO &7F3F
 90  ?byte%=&77
100 NEXT
```

PROGRAM LISTING 3

```
10 MODE5
20 GCOL 0,1
25 MOVE 0,500
30 PLOT 85,1000,500
35 A=GET
40 MOVE0,0:MOVE0,500
50 GCOL 0,2
60 PLOT 85,1000,500
65 A=GET
70 GCOL 119,1
80 MOVE0,0:MOVE0,500
90 PLOT 85,1000,500
```

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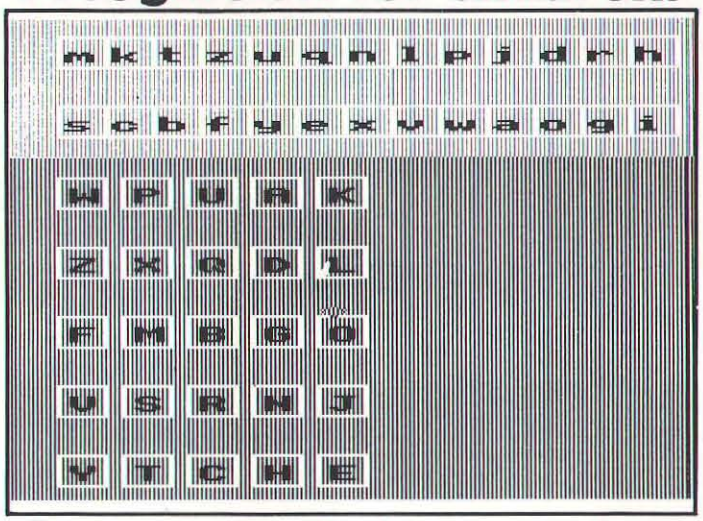


It is always difficult to produce an educational program which will hold a child's attention long enough to be of any lasting benefit. Children soon tire if a program is too serious or boring. The answer is the subtle approach to providing a game which is both fun to play and challenging but which has its roots in something educational.

It is hoped that the program presented here and called All Change fits into this category. It is played using a joystick and is for the model B micro.

Basically All Change involves selecting a lower case letter from the top of the screen and then after changing it into a capital letter in your mind, place it on top of the capital letter which can be found in one of the lower boxes. If this is done correctly, the colour of the capital letter will change. The game is completed when all 25 capital letters have had their colours changed. When this has been done the time taken is displayed, followed by your score. If this is the top score you are asked for your name.

However watch out because there are 26 lower case and only 25 capital letters. So there is a 'spare' lower case letter which can't be matched. If you pick this up your only option is to dump it in the corner and continue. This will cost you a time penalty of 30 seconds. If you dump the wrong letter and then try to get rid of another the game will end abruptly and you score nothing.

Whilst the program was written with primary school children in mind it is felt that older children will enjoy it, racing against each other – testing their observation and reflex qualities.

THE FLASHER!

Line 400 takes the logical colours 8 to 15 which are all flashing colours and re-assigns steady colours to them. This is necessary because in line 1200 we use the command GCOL4,0. From the User Guide page 167 we see that the first number (4) inverts the colour already present. That is if the cursor colour is blue and the program meets a GCOL4,0 command the cursor would then become flashing yellow/blue and this is undesirable. Making the flashing colours steady removes this effect.

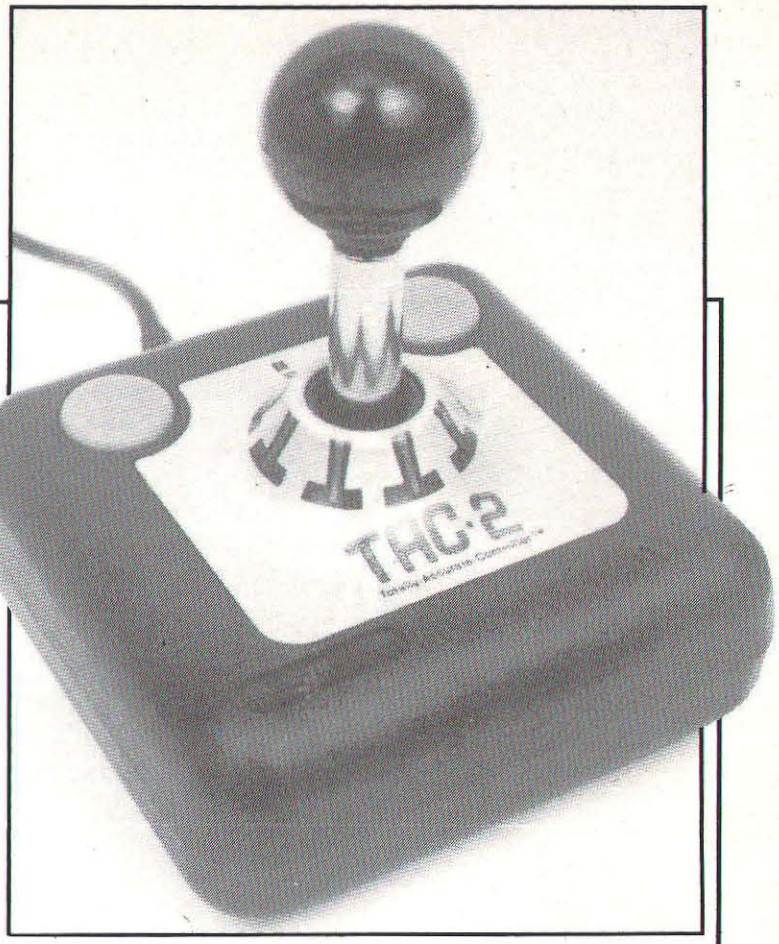
Line 50 can be altered if required. SC% is the score below which the name in N$ will be displayed. If this is found to be too high alter it to say 250. The name of the teacher can be entered into N$!!

If the instructions are not required PROCINTRO on line 70 may be omitted and the listing ended at 1480. However the instructions are deliberately written in lower case to help the young, for whom the program is intended and it is well worth leaving them in.

To ease the burden of typing lower case letters try holding down the shift key whilst pressing the caps lock key. This will make the task of entering lower case letters easy because every time you want a lower case letter just press shift followed by the letter concerned. To revert to normal all that is required is to press the Caps Lock key twice (or press break).

PROGRAM STRUCTURE

Lines	
50	Set up score (SC%), Top players name (N$) and dimensions two arrays for the small and capital letters.
60-130	Main program loop.
150-190	PROCTITLE: Prints title and sets up sound envelope.
210-440	PROCINIT:
220	In order: Sets background colour to red, clears screen, sets up a text window, sets background colour of window to cyan by clearing screen and finally resets the background to red.
250	Sets the variables ready for the start.
260-390	Draws all the boxes and prints in the letters.
400	Sets all the flashing colours to steady ones (see text).
410	Declares another text window; Resets the clock to zero.
460-500	DEFPROCTUNE: Music procedure.
520-530	Data for the tunes: notes and duration.
550-590	DEFPROCWRITE: The procedure prints the desired letter (ch) in the colour (c) at the position X%,Y%.
610-650	DEFPROCBOX: Produces a box at position X%,Y%.
670-740	DEFPROCJOY:
690-770	Reads the position of the joy stick and converts it to a position on the screen given by X%,Y%.
710	If no change in position from last sample ends procedure
720-730	Removes old star or letter and reprints at new position.
760-890	DEFPROCPLAY; (Main action loop).
780-820	Picks up a small letter from the top of the screen.
840-880	Places the letter in the capitals boxes.
910-1010	DEFPROCPICK:
920	This line waits for the joystick fire button to be released.
930	Checks for valid position of star.
950	Selects the top or bottom row of boxes.
960	Removes old star.
970	Checks if letter has already been picked.
980	Changes colour of small letter when picked.
1030-1170	DEFPROCPLACE:
1040	Waits for release of the fire button.
1050-1070	Checks to see if selection is valid.
1120	Checks for letter match.
1140	Changes the colour of the capital letter when matched.
1190-1210	DEFPROCCURSOR: Prints star or letter at X%,Y%.
1230-1320	DEFPROCSHUFFLE: Mixes up the letters before printing.
1340-1380	DEFPROCFINISH: DEFPROCSCORE: both self explanatory.
1460	Waits for fire button to be pressed before restarting the game.
1490-1610	DEFPROCINTRO: Sets up screen and prints out the playing instructions.



PROGRAM LISTING

```
  10 REM *****ALL CHANGE*****
  20 REM ****FREDA PERROW****
  50 SC%=350:N$="Jack The Flash":DIMBOX(26),CELL(26)
  60 RESTORE520:MODE1:VDU23;8202;0;0;0;
  70 PROCTITLE:PROCTUNE:PROCINTRO
  80 RESTORE520:MODE2:VDU23;8202;0;0;0;
  90 PROCINIT:REPEAT
 100   PICK=FALSE:PLACE=FALSE
 110   PROCPLAY:UNTIL CHANGE=25
 120 T=TIME DIV100:PROCFINISH:PROCSCORE
 130 GOTO60
 140 :
 150 DEFPROCTITLE
 160 COLOUR2
 170 PRINTTAB(15,15)"ALL CHANGE"''''TAB(12)"by Freda P
errow"
 180 ENVELOPE2,2,0,0,0,0,0,0,4,-1,-2,-1,126,60
 190 ENDPROC
 200 :
 210 DEFPROCINIT
 220 VDU17,129,12,28,0,8,19,0,17,134,12,17,129
 230 PROCTUNE:PROCSHUFFLE
 240 VDU5:MOVE130,65:PRINT"DUMP!":VDU4
 250 CHANGE=0:PENALTY=0:SCORE=0:D=0
 260 PROCBOX(20,20)
 270 FORx%= 100 TO 1156 STEP 88
 280   FORy%=772 TO 900 STEP 128
 290     PROCBOX(x%,y%):NEXT:NEXT
 300 I%=1
 310 FORy%=128 TO 644 STEP 128
 320   FORx%=100 TO 580 STEP 120
 330     PROCBOX(x%,y%)
 340     PROCWRITE(x%,3,CELL(I%),y%+38)
 350     I%=I%+1:NEXT:NEXT
 360 FORy%=808 TO 936 STEP 128
 370   FORI%=1TO13:X=I%*88
 380     IFy%>930 PROCWRITE(X,3,BOX(I%),y%) ELSE PROCW
RITE(X,3,BOX(I%+13),y%)
 390     NEXT:NEXT
 400 FORI%=8TO15:VDU19,I%,I%-8;0;:NEXT
 410 VDU28,12,25,19,10:TIME=0
 420 PRINTTAB(1,7)"TIME"
 430 PRINTTAB(0,11)"SECONDS"
 440 ENDPROC
 450 :
 460 DEFPROCTUNE
 470 REPEAT
 480   READP,D:SOUND2,2,P,D
 490   UNTIL D=0
 500 ENDPROC
 510 :
 520 DATA109,5,117,5,129,5,129,5,129,5,129,5,117,5,109
,5,101,5,109,5,109,0
 530 DATA101,5,109,5,117,5,129,5,129,5,137,5,129,5,117
,5,101,5,117,5,117,5,109,3,109,15,101,0
 540 :
 550 DEFPROCWRITE(x%,c,ch,y%)
 560 VDU5
 570 MOVEx%+18,y%:GCOL0,c:VDUch,4
 580 GCOL0,7
 590 ENDPROC
 600 :
 610 DEFPROCBOX(x%,y%)
 620 MOVEx%,y%
 630 DRAWx%+88,y%:DRAWx%+88,y%+56
 640 DRAWx%,y%+56:DRAWx%,y%
 650 ENDPROC
 660 :
 670 DEFPROCJOY
 680 oldx%=x%:oldy%=y%
 690 x%=(x%+1280-ADVAL(1)DIV50)DIV2
 700 y%=(y%+ADVAL(2)DIV64)DIV2
 710 IFx%DIV8=oldx% AND y%DIV4=oldy%DIV4 ENDPROC
 720 PROCCURSOR(oldx%,oldy%)
 730 PROCCURSOR(x%,y%)
 740 ENDPROC
 750 :
 760 DEFPROCPLAY
 770 PRINTTAB(1,1)"PICK ":x%=-30:y%=500
 780 REPEAT:M=42:REPEAT
 790     PRINTTAB(2,9);TIME DIV 100
 800     PROCJOY:UNTIL ADVAL(0) AND 1
 810   IFy%>772 THEN PROCPICK
 820   UNTILPICK=TRUE
 830 PRINTTAB(1,1)"PLACE":x%=512:y%=1050
 840 REPEAT:REPEAT
 850     PRINTTAB(2,9);TIME DIV 100
 860     PROCJOY:UNTIL ADVAL(0) AND 1
 870   IFx%<680 AND y%<700 PROCPLACE
 880   UNTILPLACE=TRUE
 890 ENDPROC
 900 :
 910 DEFPROCPICK
 920 VDU7:REPEAT UNTIL (ADVAL(0)AND1)=0
 930 I%=x%DIV88:IFI%<1 OR I%>13 ENDPROC
 940 ox%=x%:oy%=y%:x%=I%*88
 950 IFy%<880 y%=808:I%=I%+13 ELSEy%=936
 960 PROCCURSOR(ox%,oy%):M=BOX(I%)
 970 IF BOX(I%)=1 M=42:PROCCURSOR(x%,y%):ENDPROC
 980 PROCWRITE(x%,4,BOX(I%),y%)
 990 PRINTTAB(3,3)CHR$BOX(I%);
1000 PICK=TRUE
1010 ENDPROC
1020 :
1030 DEFPROCPLACE
1040 REPEAT UNTIL (ADVAL(0)AND1)=0
1050 M%=x%DIV120:J%=y%DIV128
1060 IFM%<1 AND J%<1 AND D=0 PLACE=TRUE:BOX(I%)=1:PENA
LTY=PENALTY+30:D=1:ENDPROC ELSE IFM%<1 AND J%<1 AND D=1
D=2:PLACE=TRUE:CHANGE=25:PENALTY=PENALTY+500:ENDPROC
1070 IFM%<1 OR M%>5 OR J%<1 OR J%>5:ENDPROC
1080 ox%=x%:oy%=y%
1090 x%=M%*120-20:y%=J%*128+38
1100 M%=(J%-1)*5+M%
1110 PROCCURSOR(ox%,oy%)
```

CONTINUED OVER

```
1120 IF BOX(I%)-32<>CELL(M%) PROCCURSOR(x%,y%):ENDPROC
1130 SOUND1,-15,250,5
1140 PROCWRITE(x%,4,CELL(M%),y%)
1150 PRINTTAB(3,3)" ":PLACE=TRUE
1160 BOX(I%)=1:CHANGE=CHANGE+1
1170 ENDPROC
1180 :
1190 DEFPROCCURSOR(x%,y%)
1200 GCOL4,0:MOVEx%-24,y%+12:VDU5,M,4
1210 ENDPROC
1220 :
1230 DEFPROCSHUFFLE
1240 FOR I%=1TO26
1250   BOX(I%)=I%+96:CELL(I%)=I%+64:NEXT
1260 FOR I%=1TO50:A%=RND(26):B%=RND(26)
1270   T%=BOX(A%):BOX(A%)=BOX(B%):BOX(B%)=T%
1280   NEXT
1290 FOR I%=1TO50:A%=RND(26):B%=RND(26)
1300   T%=CELL(A%):CELL(A%)=CELL(B%):CELL(B%)=T%
1310   NEXT
1320 ENDPROC
1330 :
1340 DEFPROCFINISH
1350 CLS
1360 IF D=2 PRINT"Dumper!!"'''"the end"ELSEPRINT"GREAT
!!!"'"YOU TOOK";TIME DIV 100''"SECONDS"'':IF PENALTY>1
PRINT"PENALTY"'"  ADD"'PENALTY;" SECS"
1370 RESTORE530:PROCTUNE:RESTORE530:PROCTUNE
1380 ENDPROC
1390 :
1400 DEFPROCSCORE
1410 VDU26,16,12
1420 IF T+PENALTY>500 THEN SCORE=0 ELSE SCORE=500-(T+P
ENALTY)
1430 PRINTTAB(0,5)"YOUR SCORE IS ";SCORE
1440 IFSCORE>SC% PRINT'''"Best Score Yet!"'''"Type You
r Name.."''':SC%=SCORE:INPUTN$:ELSE PRINT'''"Best Score
r So far"''''"Is  ";N$
1450 PRINT''''"PRESS FIRE BUTTON"'''"FOR ANOTHER GO"
1460 REPEAT:UNTIL ADVAL(0) AND 1
1470 ENDPROC
1480 :
1490 DEFPROCINTRO
1500 FORI%=1TO12
1510   TIME=0:REPEAT:UNTIL TIME>20
1520   PRINT':NEXT
1530 PRINTTAB(0,9)"ALL CHANGE is an educational style
game where  you  must pick a letter from the top of the
 screen and then  match it to its capital below."''
1540 COLOUR3
1550 PRINT"Use  the  joystick  to move  the lettersaro
und and when over the letter you wishto pickup or drop
press the FIRE button."
1560 COLOUR2
1570 PRINT'"Beware of picking a letter  from the topwh
ich can't be found below.If you do youwill have to dump
 it. This will cost youa penalty."'
1580 PRINT"If you  try to dump twice  the game willend
."'''
1590 PRINTTAB(4)"PRESS FIRE BUTTON TO START GAME"
1600 REPEAT:UNTIL ADVAL(0) AND 1
1610 ENDPROC
>
```

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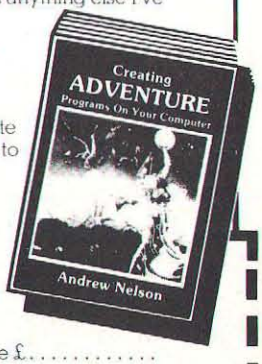

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Music Micro Please

B. M. Landsberg

Get note perfect with your BBC and the help of Bach's Piano/Flute Sonata No.2 in E♭.

In this article, I attempt to program a fairly complex piano/flute duet by Bach as faithfully as possible. Although the degree of success is not total, some interesting tricks are discussed and some potential pitfalls revealed. The reader is assumed to have some knowledge of the SOUND and ENVELOPE commands.

In the May/June 1983 edition of A&B Computing (Reference 1) I showed how to use the BBC microcomputer to capture the amplitude envelope of a sound, and how to design an ENVELOPE command to imitate it. Bearing in mind that the imitation of a musical instrument cannot by any stretch of the imagination be called a faithful reproduction, the aim of this article is to program the BBC micro to play the second movement (Siciliano) of the Sonata no. II in Eb major by J.S. Bach using the ENVELOPE commands developed in my previous article to sound as closely as possible to a harosichord/flute duet. A few pitfalls which may be encountered along the way, as well as some tricks which we will use to produce the desired effects, will be discussed and demonstrated.

The first point to be made is that the values of the pitch parameter in the SOUND command which I use to produce any given note are not the same as the values given in the BBC manual, but are in general lower by 1. Thus where the BBC manual instructs us to use the value 53 to produce the note 'Middle C', I will use 52. The advantages in tunefulness and absolute accuracy have been fully discussed in Reference 2 along with frequency measurements of all the notes produced using the SOUND command, but if you wish to follow the instructions given in the manual, simply add one to the pitch values that I use for most applications.

THE MUSIC

The music to be played is shown in Figure 1, and despite its complexity, it is immediately evident that we can assign the three sound channels to the flute part, the right-hand piano part (treble clef) and the left-hand piano part (bass clef). Furthermore, on examination of the bass, we see that there are notes to be played which, according to the BBC manual, are too low in bitch for the SOUND command to be able to produce! Don't worry — the micro can play these deep notes by using a cute little trick (to be discussed later), but only if we reserve channel 1 for the purpose. Thus we assign channel 3 to the flute part, and channels 2 and 1 to the treble and bass piano parts respectively.

Before actually coding any music, it is always wise to examine the score for any nasty surprises which may crop up — in particular it is best to identify the shortest note in the piece and assign to it a time value such that every note may be represented by a whole number. For this piece of music, the shortest note appears to be a demisemiquaver (i.e. a note with three 'tails') as in the last bar but one — but that bar also contains a trill which I wanted to be played as triplet semiquavers (i.e. three semiquavers played in the time of two). The only way to accomodate all this was to give the triplet semiquavers 6 and so on. This also turns out to be approximately the correct speed for the piece, but if it has been too fast, I would have multiplied each time value by a correction number somewhere between lines 40 and 60 — the advantage of this approach would be that changing the speed merely means altering one number in the program as opposed to editing every DATA statement!

Now we come to synchronization of the notes. This is a method of ensuring that two or more notes start being played at exactly the same time instead of whenever BASIC decides to initiate them. Very briefly, bits 8 and 9 of the channel parameter determine the synchronization, so to ensure channels 1 and 2 are played together we would use channel parameters of &101 and &102 (i.e. 257 and 258) respectively, and to ensure three channels are played together we would use &201 etc. Thus line 200 ensures that the first time three notes of the piece are started simultaneously.

Having determined the timing and assigned the channels, we now turn our attention to the dreaded ENVELOPE commands! In Reference 1, I recorded the amplitude of a rather deep note from my piano and tailored an ENVELOPE command to reproduce it as closely as possible. However, programming the music using this ENVELOPE command for the piano parts gave a very disappointing muddy sound. Puzzled by this, I listened to my piano more carefully, and it soon became clear that the higher notes die away more quickly than the lower notes! Experimenting with ENVELOPE commands to find a rate of decay suitable for both high and low notes did not produce a satisafcatory sound, and so my solution to this was to use two different ENVELOPE commands for the piano parts — the one derived from my piano for the bass notes and one which decays three times faster for the higher notes as shown in lines 10 and 20 of the program listing. This gives rise to a harpsichord-like sound with somewhat resonating bass notes. The reader is of course encouraged to experiment with all facets of this, and especially with the first argument of the ENVELOPE commands which effectively determines the timescale of the amplitude and pitch envelopes.

LOW DOWN

Now we come to the deep notes! If we wish to play a note using the SOUND command, then a pitch parameter of zero seems to produce the lowest sound we can make. Using −1 is no good as it produces the same high note as does 255! So how can we go even lower? In Reference 2, I showed that the frequency produced on channel zero by the command SOUND

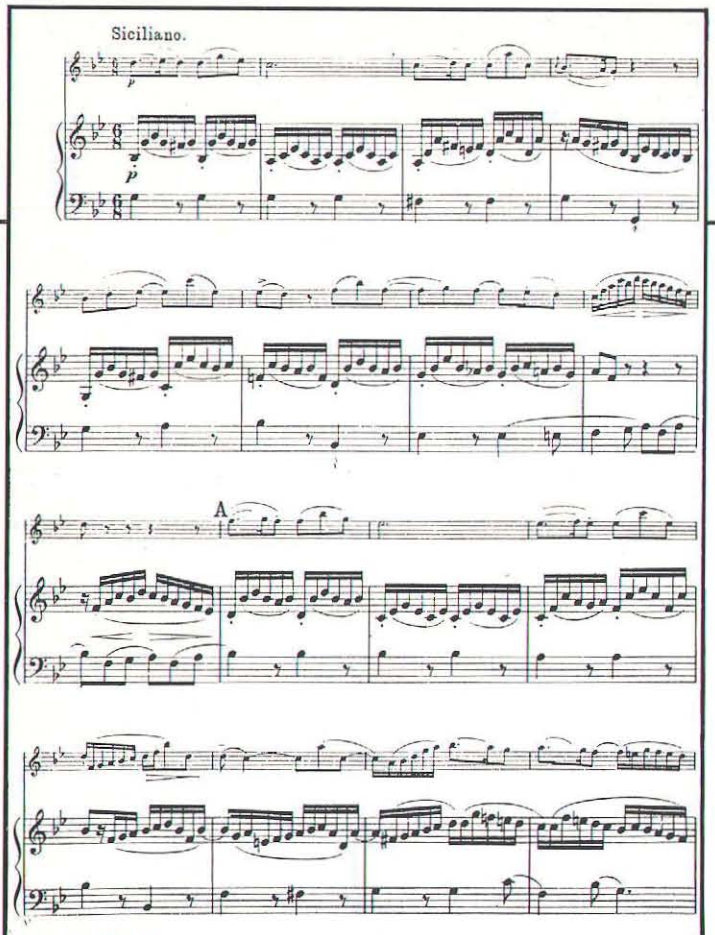


Fig. 1. The Music

0,V,3,T is exactly one fifteenth of the frequency last produced on channel 1. Thus, to play deep notes in a musical context you have to play on channel 1 the note with a frequency 15 times higher at zero volume, and sound the note with a pitch parameter of 3 on channel zero ensuring that they are synchronised. A typical sequence of commands to do this would be:

SOUND 1,0,X,T (sets up note X for T/20 seconds at zero volumn on channel 1)

SOUND 0, −15,3,T (sounds the deep note for T/20 seconds on channel 0)

Rather than using the complicated frequency table given in Reference 2, an approximate (but fairly good) table relating X to a low note is given in Table 1. For example, the following sequence will play the note two octaves below Middle C (which the SOUND command cannot normally do):

SOUND 1,143,0,20: SOUND 0, −15,3,20.

TRAPPED

At this point, I fell into a trap! The ENVELOPE command for the piano notes caused them to die away fairly slowly once the note has been played for its allotted time unless another note follows it on the same channel. However, if channel 0 is used to produce a deep note as described above and the notes following it are to be produced on channel 1 (as, for example, in bar 4 of figure 1) a series of unpleasant clicks will be emitted for a second or two while channel 0 plays the tail end of its note, but at one fifteenth of the frequency of that being played on channel 1. This rather strange pitfall puzzled me for quite a while, but once I realized what was going on the solution was fairly easy — add a dummy command like SOUND 0,0,0,0 which will cause the deeep note on channel 0 to cease as soon as it has been played for the correct time.

Now, how do we tie all this in so far? The SOUND command demands four parameters for each note, but if all notes on channel 1 are to be played using ENVELOPE number 1 and similarly for channels 2 and 3, we need only provide three pieces of information to specify each note — the *CHANNEL*, the *PITCH PARAMETER* and the *DURATION*. Thus the first part of program 1 needs three numbers from the DATA statements for each note and translates them into the four SOUND command parameters. The DATA statements start at line 200, and each DATA statement is intended to correspond to one bar of the music in order to make it easier to relate data to a specific note — the only exceptions to this being when notes 'spill over' from one bar to the next. Also, the numbers in the DATA statements are grouped into units of three to correspond to each note. This uses a little extra memory, but makes development and interpretation of the program much easier.

The two cases that are not so straightforward are the pauses (or 'rests') and the deep notes. If we were to have used four numbers to specify each note, rests would have been very easy to include as we would simply feed in directly a volume parameter of zero. I have somewhat arbitrarily chosen the convention that a pitch parameter of one (which is never used in this piece of music and anyway does not correspond to a proper note using our more tuneful scheme) will represent a rest, and this has been implemented in line 50 of the program. Thus 2,52,20 would be interpreted as SOUND 2,2,52,20 while 2,1,20 would be interpreted as SOUND 2,0,0,20 — thus pausing for the allotted time!

For the deep notes, we could specifically put the correct numbers for channels 0 and 1 into the DATA statements, but this is clumsy, long-winded and harder for the programmer to read. Instead, a negative value for the pitch parameter will set up the note according to Table 1, and this is done in line 73 of the program. Thus 1, −143,20 corresponds to the sequence :

SOUND &101,0,143,20 : SOUND &100,1,3,20: SOUND 0,0,0,0

which plays the note two octaves below Middle C synchronizing channel 0 with channel 1 and ensuring that the note gets cut off so its decay does not interfere with the music as described above.

Having sorted out the piano envelopes and deep notes we now turn to the problem of the flute. By far the easiest thing is to leave the BBC micro to produce its own uninteresting sound and pass it off as the best we can do (or perhaps play the flute part an octave higher by adding 48 to each pitch parameter). However, in Reference 1 it was demonstrated that flute notes may get louder and softer about five times per second, and we will attempt to coerce the BBC micro into imitating this. It does not seem to be possible to devise an ENVELOPE command such that a long wavering note may be produced by just one SOUND command. If the pitch were to waver, an auto repeat of the weavering through to the end of the note is easily programmable, but for amplitude changes we have to string together many SOUND commands. The ENVELOPE command in line 30 of the listing defines one cycle (which lasts for a fifth of a second) and the continuous waver is produced in the subroutine starting at line 100. Any note which lasts for less than one fifth of a second is to be played without using an ENVELOPE command. As will be seen in the next paragraph in using this method one must take extreme care not to overfill the music buffer.

STRINGING SOUNDS TOGETHER

The next problem is to play long sustained flute notes with the amplitude modulation mentioned earlier. The ENVELOPE command will only play one cycle (i.e. one fifth of a second), and so many SOUND commands have to be strung together to make one long note. The difficulty is that any SOUND command which has not actually been started sits in queue which only holds 6 en-

CONTINUED OVER

tries. Thus if too many notes on channel 3 are in the queue, the notes in channels 1 and 2 will have to wait their turn and the music will become totally unsynchronised. The result is unpleasant to hear to say the least! There is no easy way round this problem (which may occur for any complex piece of music) and attempting to use synchronization to sort it out may easily cause the program to 'hang'. The only solution is to be very careful that the notes are fed into the queue in the correct order, such that no more than six notes are ever waiting to be started at any time. To do this, there seems to be no hard and fast rules, but a good guideline to avoid too many notes in the queue is to always issue SOUND commands for the longest notes first. Thus, in general, the long bass piano notes will be called first, followed by as many notes on channel 2 as you can 'get away with', finally followed by the flute notes which in fact may issue very many SOUND commands on channel 3 for just one note! Follow the DATA statements on the program to see how this has been done. It turns out to be impossible to handle the long flute notes such as in the second bar, and unfortunately they have to be split into two smaller ones.

Having gone to all the trouble of writing this program, the music it produces is still a little rough! The reason for this seems to lie in the ENVELOPE commands which may vary the amplitude on the assumption that there are 127 different volume levels — in fact there are only 16 in the current version of the BBC micro. This means that rather than varying fairly smoothly, the amplitude makes somewhat large jumps which results in a coarser sound, especially for the flute part. If this is too offensive, the bland BBC note may be reinstalled by replacing line 60 with the following:

IF C MOD 256 = 3 AND V 0 THEN SOUND C, −15,P,T, : SOUND 3,0,0,0: GOTO 30.

It is possible to play the tune in a different key — imagine you wanted to play an instrument or sing along with the piece, but wanted it 2 semitones higher to put it in C major. All we need to do is to increase the pitch parameter for each note by 8, and this is done by inserting the following line:

55 IF P>1 THEN p=p+8 ELSE IF P<1 THEN p=p−8

The first IF is so that pauses (represented by values of 1 for P) remain silent, and the second is because we have used *NEGATIVE* values of P to represent deep notes. If instead you try to play it lower, you will run into trouble if a note played by a normal SOUND command goes from a positive value to a negative one as it will only produce a high-pitched squeak! You can, however, transpose it down one semitone as note 0 is not used in this piece.

FURTHER DEVELOPMENT

Now we have constructed a program to play a rather sophisticated piece of music, and are aware of a few of the tricks and hazards involved, it should be said that it is still by no means perfect. For example, what about some of the notes being staccato (played and ended abruptly), or some portions of the music being louder (or more stressed) than others? How may we improve on this program?

As far as accentuation and volume control are concerned, the program may be written using more ENVELOPE commands with some of them being similar in amplitude variation, but played at a lower volume — for example a quieter version of ENVELOPE number 1 would be ENVELOPE 1,3,0,0,0,0,0,0,126, −1,0,-−2,64,0. Up to 16 different ENVELOPE commands may be defined, provided the BASIC statement BPUT# is not being used.

This may be intregrated into the program either by having four numbers in the DATA statement for each note, or by encoding these variations into, say, the channel parameter. A typical method might have channel parameters of 1,4,7... playing quieter and quieter envelopes on channel 1, and similarly for 2,5,8.. and 3,6,9...

For phrasing, some notes need to be played staccato, and this may be done either by defining yet more ENVELOPE commands, or more easily by splitting the note into two parts — one part being played for a short time and the second part being played at zero volume to make up the total duration of the note and in addition cutting off the decay of the note abruptly. Thus a staccato version of SOUND 1,1,52,20 might be the sequence SOUND 1,1,52,12:SOUND 1,0,0,8. The degree of 'abruptness' may be altered by varying the relative duration of the two parts of the note.

All of this leaves plenty of scope for experimentation and ingenuity so once you have enjoyed listening to the Siciliano movement, get into the program and improve it to your satisfaction — it is the next best thing to musical expression!!

TABLE 1

HOW TO PRODUCE LOW NOTES USING THE SOUND COMMAND

		p	X
ONE OCTAVE BELOW MIDDLE	C	4	191
	B	0	187
	Bb,A#	—	183
	A	—	179
	Ab,G#	—	175
	G	—	171
	Gb,A#	—	167
	F	—	163
	E	—	159
	Eb,D#	—	155
	D	—	151
	Db,C#	—	147
TWO OCTAVES BELOW MIDDLE	C	—	143

p — Produced using SOUND 1, −15,P,T. If there is no entry, then the note is too low for the normal BBC SOUND command.

X — Produced using SOUND 1,0,X,T : SOUND 0, −15,3,T

It should be stressed that this is only a convenient approximation to the low notes — for more accurate values refer to the frequency table in Reference 2 .

REFERENCES

1 "The Sound of Music" B.M. Landsberg A&B Computing May/-June 1983 pp 19-23

2 "Extending the BBC's SOUND Command" B.M. Landsberg Electronics & Computing February 1983 pp 23-25.

PROGRAM LISTING

```
 10 ENVELOPE 1,3,0,0,0,0,0,0,126,-1,0,-2,126,0
 20 ENVELOPE 2,1,0,0,0,0,0,0,126,-1,0,-2,126,0
 30 ENVELOPE 3,1,0,0,0,0,0,0,2,-2,0,-4,126,106
 40 READ C,P,T : IF C < -3 THEN END
 50 V=C : IF P=1 THEN V=0
 60 IF C=3 AND V<>0 THEN GOSUB 100 : GOTO 30
 70 IF P<0 THEN SOUND &101,0,-P,T : SOUND &100,1,3,T :
SOUND 0,0,0,0 ELSE SOUND C,V,P,T
 80 GOTO 30
100 IF T<4 THEN SOUND C,-15,P,T : RETURN
110 SOUND C,-12,P,1
120 Q=(T-1)/4
130 FOR I = 1 TO Q : SOUND C,3,P,4 : NEXT I
140 SOUND C,3,P,T-4*INT(Q)-1 : SOUND C,0,0,0
150 RETURN
```

```
200 DATA &201,32,24, &202,44,6, &203,108,18, 2,80,6, 2,
92,6, 1,1,12, 2,80,6, 2,76,6, 2,80,6, 3,112,6, 3,108,12,
1,32,24, 2,44,6, 2,80,6, 2,92,6, 3,108,12, 1,1,12, 2,80,6
, 2,76,6, 2,80,6, 3,128,12, 3,112,12
210 DATA 1,32,24, 2,40,6, 2,52,6, 2,64,6, 2,52,6, 2,40,
6, 2,52,6, 1,1,12, 1,32,24, 3,100,36, 2,40,6, 2,52,6, 2,6
4,6, 2,52,6, 2,40,6, 2,52,6, 1,1,12, 3,100,36
220 DATA 1,28,24, 2,40,6, 2,60,6, 2,88,6, 3,100,18, 1,1
,12, 2,76,6, 2,68,6, 2,76,6, 3,108,6, 3,100,12, 1,28,24,
2,60,6, 2,88,6, 2,100,6, 3,100,12, 3,136,12, 1,1,12, 2,88
,6, 2,60,6, 2,88,6, 3,100,12
230 DATA 1,32,24, 2,1,6, 2,88,6, 2,80,6, 3,100,6, 3,92,
12, 1,1,12, 2,76,6, 2,80,6, 2,60,6, 3,88,6, 3,80,12, 1,-1
71,24, 2,44,6, 2,64,6, 2,60,6, 3,1,36, 1,1,12, 2,52,6, 2,
60,6, 2,44,6
240 DATA 1,32,24, 2,32,6, 2,80,6, 2,92,6, 3,92,12, 3,10
8,12, 1,1,12, 2,80,6, 2,76,6, 2,80,6, 1,40,24, 2,52,6, 2,
100,6, 2,112,6, 3,112,24, 1,1,12, 2,100,6, 2,92,6, 2,100,
6, 3,148,12, 3,112,12
250 DATA 1,44,24, 2,72,6, 2,100,6, 2,92,6, 3,112,12, 3,
108,12, 1,1,12, 2,88,6, 2,92,6, 2,72,6, 3,1,12, 1,-183,24
, 2,60,6, 2,92,6, 2,108,6, 3,120,12, 3,140,12, 1,1,12, 2,
92,6, 2,88,6, 2,92,6, 3,120,24
260 DATA 1,16,24, 2,80,6, 2,92,6, 2,112,6, 3,128,12, 1,
1,12, 2,92,6, 2,84,6, 2,92,6, 3,120,24, 1,16,24, 2,80,6,
2,92,6, 2,100,6, 3,112,12, 1,20,12, 2,88,6, 2,92,6, 2,80,
6, 3,108,12
270 DATA 1,24,24, 2,88,12, 2,72,12, 3,100,6, 3,120,6, 3
,136,6, 1,32,12, 2,1,48, 3,148,6, 3,140,6, 3,156,6, 1,40,
12, 1,24,12, 3,148,6, 3,140,6, 3,136,6, 1,40,12, 3,128,6,
3,120,6, 3,112,6
280 DATA 1,44,12, 2,1,6, 2,72,6, 2,88,6, 3,108,12, 3,1,
60, 1,24,12, 1,32,12, 2,100,6, 2,92,6, 2,108,6, 1,40,12,
1,24,12, 1,40,12, 2,100,6, 2,92,6, 2,88,6, 2,80,6, 2,72,6
, 2,64,6
290 DATA 1,44,24, 2,60,6, 2,92,6, 2,108,6, 3,120,18, 1,
1,12, 2,92,6, 2,88,6, 2,92,6, 3,128,6, 3,120,12, 1,44,24,
2,60,6, 2,92,6, 2,108,6, 3,120,12, 3,140,12, 1,1,12, 2,9
2,6, 2,88,6, 2,92,6, 3,128,12
300 DATA 1,44,24, 2,52,6, 2,64,6, 2,80,6, 2,64,6, 2,52,
6, 3,112,36, 2,64,6, 1,1,12, 1,44,24, 2,52,6, 2,64,6, 2,8
0,6, 2,64,6, 2,52,6, 2,64,6, 1,1,12, 3,112,36
310 DATA 1,40,24, 2,52,6, 2,72,6, 2,100,6, 3,112,18, 1,
1,12, 2,88,6, 2,80,6, 2,88,6, 3,120,6, 3,112,12, 1,40,24,
2,72,6, 2,100,6, 2,112,6, 3,112,12, 3,148,12, 1,1,12, 2,
100,6, 2,72,6, 2,100,6, 3,112,12
320 DATA 1,44,24, 2,92,12, 2,1,6, 3,108,6, 3,72,6, 3,80
,6, 1,1,12, 2,72,6, 2,80,6, 2,88,6, 3,88,6, 3,92,6, 3,100
,6, 1,-183,24, 2,92,6, 2,100,6, 2,108,6, 3,108,6, 3,120,6
, 3,140,12, 1,1,12, 2,92,6, 2,72,6, 2,92,12, 3,108,12
330 DATA 1,24,24, 2,80,6, 2,88,6, 2,68,6, 3,108,12, 2,7
2,6, 2,80,6, 1,1,12, 3,100,36, 1,28,24, 2,88,6, 2,92,6, 2
,100,6, 3,136,12, 1,1,12, 2,88,6, 2,60,6, 2,88,12, 3,100,
18
340 DATA 1,32,24, 2,76,6, 2,80,6, 2,88,6, 2,92,6, 2,100
,6, 1,1,12, 1,32,24, 3,88,6, 3,92,6, 2,108,6, 2,108,6, 2,
128,6, 3,108,6, 3,128,6, 3,136,6, 3,140,18, 1,52,12, 2,12
0,6, 2,116,6, 2,108,6, 3,136,6, 3,128,12
350 DATA 1,24,24, 2,100,6, 2,100,6, 2,120,6, 3,136,18,
2,116,6, 2,108,6, 2,100,6, 1,44,12, 3,128,6, 3,120,18, 1,
32,36, 2,92,6, 2,100,6, 2,92,6, 3,116,6, 3,128,6, 2,88,6,
2,80,6, 2,72,6 ,3,120,6, 3,116,6, 3,108,6
360 DATA 1,40,24, 2,68,6, 2,84,6, 2,88,6, 3,104,24, 1,1
,12, 2,68,6, 2,72,6, 2,60,6, 3,108,12, 1,40,24, 2,56,24,
3,116,6, 3,132,6, 3,136,6, 3,116,6, 1,1,12, 2,60,12, 3,12
0,6, 3,108,6
370 DATA 1,40,24, 2,68,6, 2,84,6, 2,88,6, 3,104,24, 1,1
,12, 2,68,6, 2,72,6, 2,60,6, 3,108,12, 1,40,24, 2,56,24,
3,116,6, 3,132,6, 3,136,6, 3,116,6, 1,1,12, 2,60,12, 3,12
0,6, 3,108,6
380 DATA 1,40,6, 1,-179,6, 1,40,6, 2,68,12, 3,104,6, 3,
108,6, 3,116,12, 2,40,12, 1,32,6, 1,24,6, 1,12,6, 2,1,48,
3,88,12, 1,32,24, 1,1,12, 3,92,6, 3,108,6, 3,104,6, 3,10
8,6, 3,116,6, 3,108,6
390DATA 1,24,24, 2,1,72, 3,88,6, 3,108,6, 3,104,6, 3,10
8,6, 1,1,12, 3,116,6, 3,108,6, 1,20,12, 3,80,6, 3,92,6, 3
,88,6, 1,8,12, 3,80,6, 1,-179,12, 3,72,6, 3,68,6
400 DATA 1,12,6, 1,40,6, 1,60,6, 2,1,24, 3,72,12, 3,60,
12, 3,1,48, 1,52,6, 1,44,6, 1,32,6, 2,108,12, 1,52,24, 2,
112,6, 2,128,6, 2,124,6, 2,128,6, 1,1,12, 2,136,6, 2,128,
6
410 DATA 1,44,24, 3,1,72, 2,108,6, 2,128,6, 2,124,6, 2,
128,6, 1,1,12, 2,136,6, 2,128,6, 1,40,12, 2,100,6, 2,112,
6, 2,108,6, 1,28,12, 1,12,12, 2,100,6, 2,92,6, 2,88,6
420 DATA 1,32,24, 2,44,6, 2,80,6, 2,92,6, 3,108,18, 1,1
,12, 2,80,6, 2,76,6, 2,80,6, 3,112,6, 3,108,12, 1,32,24,
2,44,6, 2,80,6, 2,92,6, 3,108,12, 3,128,12, 1,1,12, 2,80,
6, 2,76,6, 2,80,6, 3,112,12
430 DATA 1,32,24, 2,40,6, 2,52,6, 2,64,6, 2,52,6, 2,40,
6, 2,52,6, 1,1,12, 1,32,24, 3,100,36, 2,40,6, 2,52,6, 2,6
4,6, 2,52,6, 2,40,6, 2,52,6, 1,1,12, 3,100,36
440 DATA 1,28,24, 2,40,6, 2,60,6, 2,88,6, 3,100,18, 1,1
,12, 2,76,6, 2,68,6, 2,76,6, 3,108,6, 3,100,12, 1,28,24,
2,60,6, 2,88,6, 2,100,6, 3,100,12, 3,136,12, 1,1,12, 2,88
,6, 2,60,6, 2,88,6, 3,100,12
450 DATA 1,32,24, 2,80,18, 3,92,6, 3,80,6, 3,88,6, 1,1,
12, 2,72,6, 2,64,6, 2,60,6, 3,92,6, 3,100,6, 3,108,6, 1,4
,24, 2,52,12, 2,100,6, 3,112,6, 3,120,6, 3,112,6, 1,1,12,
2,92,6, 2,88,6, 2,80,6, 3,108,6, 3,100,6, 3,92,6
460 DATA 1,12,24, 2,76,24, 3,88,6, 3,104,6, 3,108,6, 1,
1,12, 2,80,12, 3,88,6, 3,92,6, 3,80,6, 1,12,24, 2,88,6, 2
,104,6, 2,108,6, 3,76,24, 1,1,12, 2,88,6, 2,92,6, 2,80,6,
3,80,12
470 DATA 1,12,24, 2,76,24, 3,88,6, 3,104,6, 3,108,6, 1,
1,12, 2,80,12, 3,88,6, 3,92,6, 3,80,6, 1,12,24, 2,88,6, 2
,104,6, 2,108,6, 3,76,24, 1,1,12, 2,88,6, 2,92,6, 2,80,6,
3,80,12
480 DATA 1,12,24, 2,76,6, 2,68,6, 2,76,6, 3,88,6, 3,80,
6, 3,88,6, 1,1,12, 2,80,6, 2,88,6, 2,92,6, 3,92,6, 3,100,
6, 3,108,6, 1,-167,24, 2,100,12, 2,92,12, 3,112,12, 3,108
,12, 1,1,12, 2,88,12, 3,100,12
490 DATA 1,-171,12, 2,80,45, 3,92,6, 3,108,6, 3,100,6,
1,-179,12, 1,-183,12, 3,92,6, 3,88,6, 3,80,6, 1,4,12, 2,8
8,3, 3,112,9, 3,100,3, 1,12,12, 1,-151,12, 2,80,12, 2,76,
12, 3,92,12, 3,88,12
500 DATA 1,32,24, 2,1,6, 2,80,6, 2,92,6, 3,80,12, 3,108
,12, 1,1,12, 2,80,6, 2,76,6, 2,80,6, 3,92,12, 1,16,24, 2,
44,6, 2,80,6, 2,92,6, 3,80,12, 3,128,12, 1,1,12, 2,80,6,
2,76,6, 2,80,6, 3,92,12
510 DATA 1,8,24, 2,1,6, 2,80,6, 2,76,6, 3,1,6, 3,92,6,
3,88,6, 1,1,12, 2,80,6, 2,92,6, 2,80,6, 3,92,6, 3,128,6,
3,92,6, 1,12,24, 2,80,9, 2,88,3, 3,92,9, 3,100,3, 1,-151,
12
520 DATA 2,80,2, 2,76,2, 3,92,2, 3,88,2, 2,80,2, 2,76,2
, 3,92,2, 3,88,2, 2,80,2, 2,76,2, 3,92,2, 3,88,2, 2,80,3,
2,76,3, 3,92,3, 3,88,3, 2,80,6, 3,80,6
530 DATA 1,-171,72, 2,80,72, 3,80,72
999 DATA -9,-9,-9
```

Disc Menu

Dave Carlos

Single key press access to your disc files. Discover your Acorn DFS while building this most useful of disc drive utilities.

Although mainly of interest to Disc user this program and article explain one way the indirection operators can be used in BBC BASIC. The program can be placed onto any disc after formatting and will provide a Menu of all the files on the disc so that you may load any one on a single key press.

HEART OF THE PROGRAM

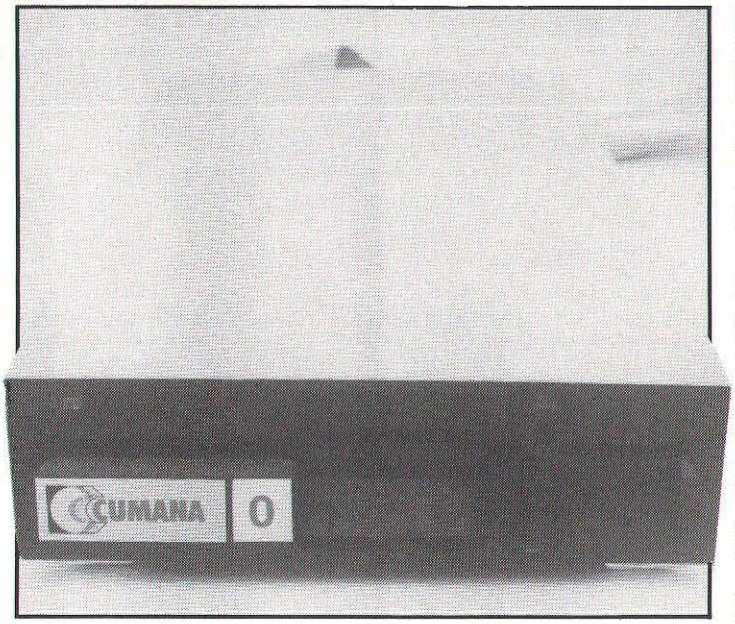
The heart of this program is the procedure 'peek' which enables us to get all the informaton we need to make a disc menu from the memory of the computer. This is made possible by the way the Acorn DFS writes the two sectors on which all the catalogue information is stored, into memory on the first reading of the disc. This is stored from &E00 to &FFF and holds not only the file titles but also their load addresses, lengths and execution addresses, in fact all that the machine needs to know in order to successfully LOAD or CHAIN a file.

Of course it is perfectly possible to write a menu program with all the file names on the disc as DATA statements or even as literal strings but this is not much use if you are still developing the disc and adding new files to it at regular intervals. This program doesn't need to have a any information added to it, as it gets all the information it needs from the catalogue sectors of the disc, after they have been read into memory. So, every time you add a new file that name is added to the catalogue and therefore will appear in the menu the next time you use this program.

HOW IT WORKS

I have written the program with long variable and procedure names in order for it to be as easy to follow as possible. There are however some rather strange looking lines which need explanation.

The main program loop is from 10 to 50 where the procedures are called. The first, 'disctitle' tries to find the title of the disc. This is held in bytes 0 to 7 of the first sector of the disc and bytes 0 to 3 of the second. It can never be more than 12 characters long and if less than 12 characters is followed by bytes valued '0'. This means that if we encounter a value of '0' in these locations the title has ended, hence the value '0' on line 600. This line gets the first eight characters and only goes to find the rest if no '0' has been found (line 620). If a '0' has not been found then it PEEKs the rest of the title from the second catalogue sector which starts at &F00 in memory. In PROCpeek it would have been possible to PEEK four locations at a time in order to get this information, by using the '!' indirection operator, but to make the procedure more flexible I have used only the byte operator '?'. If there is no title on the disc then, in order to avoid a blank banner being produced by line 240, disctitle$ is set to 'Disc Menu".



The next procedure called is 'getfilenames' which does just that. These are held in the area from &E08 upwards, with up to 31 of them. They each take up seven locations with the eight specifying the directory. In addition the most singnificant bit of the byte is set if the file is locked. (This is the reason behind the lines 280,290 and 310 in PROCmenu where this bit is masked by using MOD 128 before testing to see if the file is in directory '$'.) In order for the files '!BOOT' and 'MENU' not to appear in the list of files the offset pointer is used. This means we can ignore these two files and only read the ones for the menu itself. The offset works by increasing the location we are PEEKing by eight if only one of the specified files or by 16 if both have been found. Line 680 simply finds the number of files on the disc by PEEKing byte &F05 where the number is held. This byte is incremented by eight for every file held hence the division by eight on line 680. It is this value that is used to terminate the FOR/NEXT loop from line 700 to 760. The subtraction of two means we do not waste space on '!BOOT' and 'MENU' as the arrays can be smaller. The file names are then read into the array, as are the directory names. The use of &FF on line 740 as a limiting value is simply to keep the syntax correct, no terminating value is needed, for the directory byte is only a single location!

PRESENTATION

Now we are ready to produce the Menu and the main concern from here onwards is that the screen appearance should be as pleasant as possible. Therefore there are extra lines added to do this. PROCdouble is used to emphasise the headings and prompts in both this procedure and in PROCcheck. In order to provide an output in two columns line 270 is included, it simply checks for even numbers and TABs to column 23 if one is found otherwise it starts a new line. It also checks for less than 19 file names, if there are less than this number then it is possible to double space them on the screen and it takes the appropriate action. I decided that the directory '$' being the default directory didn't need to appear in front of the file names, so lines 280 to 310 only print the directory name if it is not '$'. The rest of the procedure GETs the file name to be loaded and checks to see if it looks like BASIC.

This procedure (PROCcheck) PEEKs the relevant part of the file specifications and if the byte found is not &80 then suggests that the file is not BASIC but still gives you the option to CHAIN it if you desire. The usual EXEC address for BASIC files is either &801F (BASIC 1) or &8023 (BASIC 2) and therefore only the most significant byte need be checked. Micronet software saves files using the PAGE setting as the EXEC address which prompted me to give you the option to CHAIN the file if you wished. CHAINing a SPOOLED file or a

machine code program meant to be *RUN leads to 'Bad Program' errors.

FURTHER DEVELOPMENT

The utility of this program is not yet fully exhausted. You will probably be thinking of extensions as soon as you use it for the first time. One of the ideas I wish to pursue is that of having different directories for files which should be *EXECed or *RUN etc. Then if this was checked in the program the appropriate action could be taken. Another is that only the first program of those in a linked series (eg the three parts of SNAPPER) should appear in the menu. I will probably do this by placing the second and subsequent parts into another directory which the program specifically excludes from the list. You are bound to think of other ideas, feel free to experiment. You can only learn more about the DFS as you do so!

USING THE PROGRAM

Once you have typed the program into memory I suggest you SAVE it using the filename 'MENU'.

Then you need to create a '!BOOT' file by using the *BUILD command. To do this type the following:

*BUILD !BOOT return
the computer will respond with
1
TYPE CHAIN "MENU" return
the computer will respond with
2
Press ESCAPE at this point.

You have now created a '!BOOT' file, so all you have to do is tell the machine what to do with it. This is done using the *OPT4 command. You wish the computer to *EXEC the '!BOOT' file you have just created and this is option 3 so you should type *OPTA4,3 return and this will be transfered to the disc.

All that is needed when you wish to use the disc now, is to insert it and to press SHIFT and BREAK at the same time.

To transfer the programs to a new disc which I suggest you do straight away after formatting them type *COPY S D !BOOT return and *COPY S D MENU return , where S is the Source drive number and D is the Destination drive number.

VARIABLE LIST

Name	*Line Numbers*	*Purpose of Procedure*
peek	70-140	Uses the indirection operator (?) to PEEK values from memory.
double	160-210	Prints the messages in double height characters.
menu	230-400	prints the file list on screen and asks which to CHAIN.
check	420-560	Checks to see if the action address of the selected file is &80 (if not the file might not be BASIC).
disctitle	580-640	Gets the disc title from memory and stores it.
getfilenames	660-770	Finds the number of files, dimensions the arrays and the PEEK the names and directories from memory.

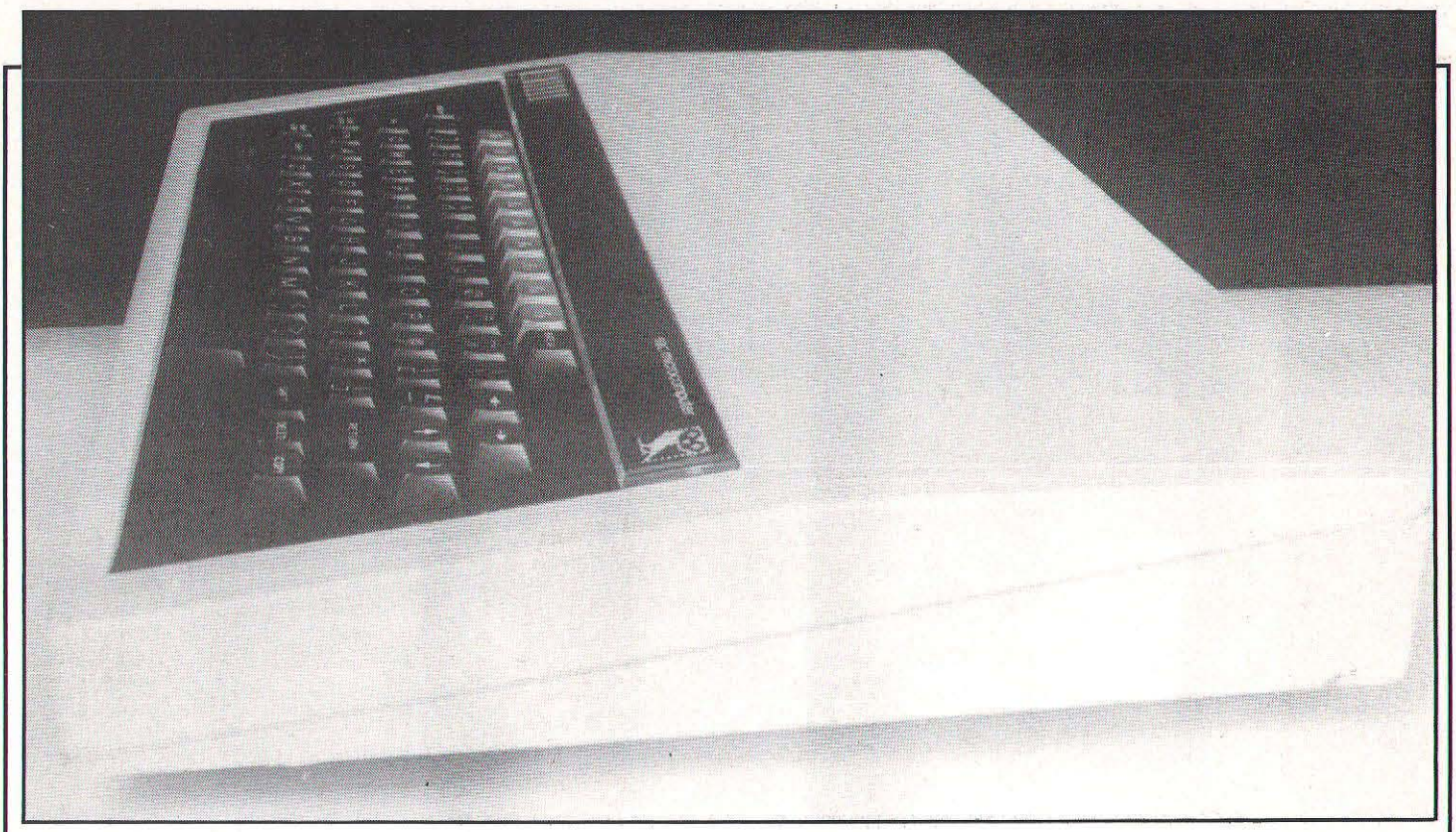
PROCEDURE LIST

Variable Name	*Type* *S = String* *I = Integer* *R = Real* *A = Array*	*Purpose of Variable*
memorybase%	I	Sets the start position when PEEKing memory.
no%	I	Number of locations to be PEEKed.
limit%	I	The limiting value (if this is found PEEKing to stop).
counter%	I	Used to increment from base value when PEEKing.
string$	S	Temporary location for the string the PEEKing generates and as the variable to be passed to PROCdouble.
disctitle$	S	Disc Title of there is one.
count%	I	FOR/NEXT loop counter.
fileno%	I	Number of files on the disc-2.
dir%	I	ASCII value of the directory that the file is in.
dir$	SA	The directory that the file is in.
file$	SA	The file name.
reply%	I	Reply to the loading message.
answer%	I	Answer to the checking message.
offset%	I	Offsets memory base value when PEEKing so that !BOOT and MENU files do not appear.

PROGRAM LISTING

```
  0  REM ******************
  1  REM **   Disc Menu   **
  2  REM **    Utility    **
  3  REM **               **
  4  REM **      By       **
  5  REM **  Dave Carlos  **
  6  REM **               **
  7  REM **      For      **
  8  REM ** A&B Computing **
  9  REM ******************
 10  MODE 7
 20  PROCdisctitle
 30  PROCgetfilenames
 40  PROCmenu
 50  END
 60  :
 70  DEF PROCpeek(memorybase%,no%,limit%)
 80  counter% = 0
 90  string$ = ""
100  REPEAT
110  IF counter%?memorybase%<>limit%string$ = string$
+ CHR$(counter%?memorybase%)
120  counter% = counter%+1
130  UNTIL counter%?memorybase% = limit% OR LEN(strin
g$)>no%
```

CONTINUED OVER



```
140  ENDPROC
150  :
160  DEF PROCdouble(string$)
170  FOR Y% = 0 TO 1
180  PRINT CHR$(132); CHR$157; CHR$(134); CHR$141; TA
B(19-( LEN(string$)/2));string$;
190  IF Y% = 0 PRINT
200  NEXT
210  ENDPROC
220  :
230  DEF PROCmenu
240  PROCdouble(disctitle$)
250  PRINT '
260  FOR count% = 1 TO fileno%
270  IF count%/2 = INT(count%/2) THEN PRINT TAB(23);
ELSE IF (fileno%<19) PRINT '' TAB(4); : ELSE PRINT TAB(
4);
280  dir% = ASC(dir$(count%))
290  dir% = dir% MOD 128
300  PRINT CHR$(129); CHR$(count%+64);" _"; CHR$( RND
(5)+129);
310  IF dir%<>36 PRINT dir$(count%);"."; ELSE PRINT "
";
320  PRINT file$(count%);
330  NEXT
340  PRINT '
350  PROCdouble("Which File to load ?")
360  REPEAT
370  reply% = GET-64
380  UNTIL reply%>=0 AND reply%<=fileno%
390  PROCcheck(reply%)
400  ENDPROC
410  :
420  DEF PROCcheck(no%)
430  IF ?(&F03+reply%*8) = &80 CHAIN dir$(reply%)+"."
+file$(reply%)
440  CLS
450  PROCdouble(file$(reply%))
460  PRINT
470  PROCdouble("may not be BASIC")
480  PRINT '''
490  PROCdouble("Press SPACE BAR to try again")
500  PRINT
510  PROCdouble("or C to CHAIN anyway!")
520  REPEAT
530  answer% = GET
540  UNTIL answer% = 32 OR answer% = 67
550  IF answer% = 67 CHAIN dir$(reply%)+"."+file$(rep
ly%) ELSE CLS : PROCmenu
560  ENDPROC
570  :
580  DEF PROCdisctitle
590  disctitle$ = ""
600  PROCpeek(&E00,7,0)
610  disctitle$ = string$
620  IF LEN(disctitle$) = 8 PROCpeek(&F00,3,0) : disc
title$ = disctitle$+string$
630  IF disctitle$="" disctitle$="Disc Menu"
640  ENDPROC
650  :
660  DEF PROCgetfilenames
670  offset% = 0
680  fileno% = ?&F05/8-2
690  DIM file$(fileno%),dir$(fileno%)
700  FOR count% = 1 TO fileno%
710  PROCpeek(&E00+(count%+offset%)*8,6,&20)
720  IF string$ = "!BOOT" OR string$ = "MENU" offset%
 = offset%+1 : GOTO 710
730  file$(count%) = string$
740  PROCpeek(&E00+(count%+offset%)*8+7,0,&FF)
750  dir$(count%) = string$
760  NEXT
770  ENDPROC
```

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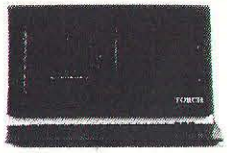

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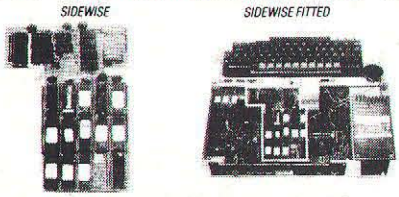

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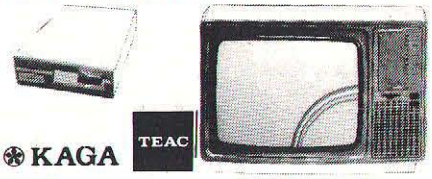

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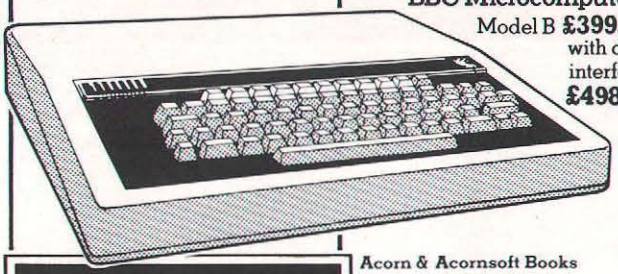

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In The Beginning

G.W. Gallagher

Continuing the project to set up a school database, this article puts the computer to work at some of the more detailed and laborious tasks of school administration.

In the previous article we worked out a program which would enable anyone interested to set up a file containing useful information about pupils in a school. The details filed were roll number, name, form, feeder school, catchment area, date of birth, plus the vital distinction between male or female!

All this information may be required for useful lists, but there is one more set of details which is often needed; and that is the subjects taken by a particular pupil. This section is likely to be individual to a particular educational establishment, and therefore requires thought before the program is compiled.

THE AGE GROUPS CONCERNED

In a secondary school which has a sixth form, the subjects will include those taken at A level and O level as well as the spread of subjects taken in lower forms.

At this stage, it is useful to consider Form 7, which is one laborious piece of work at which the computer excels! Apart from the grouping by ages, which is already covered in the file, there is the extra section of the form which requires pupils over 15 to be classified by examination subjects being studied. This implies that the computer must be able to distinguish between O and A level subjects.

For the purpose of this program, A levels are defined in capital letters, O levels in lowercase and CSE or CEE as the letter C with a number, since these subjects are often in fact groups of disciplines, taken together.

It is important to stop at this stage, and work out what is required for the particular school for which the program is to be used. Program listing 1 gives a suggested list of A level subjects. Program listing 2 gives a suggested list of O level subjects. Program listing 3 gives a space for CEE or CSE.

When taken with the age, this will give the information which the computer will need to collect the figures for Form 7.

THE SUBJECT LISTS SHOULD BE COMPILED BEFORE THE REST OF THE PROGRAM IS COMPLETED.

ADDING THE SUBJECTS TO THE FILE

At this stage, we are faced with a file of records, none of which include subjects. Even when the file is running, it will need to be updated each year, and this particular one of the suite of programs concentrates on adding the subjects, or if required, on changing the subjects. Alterations to other parts of the records will be dealt with separately.

Three different ways of calling up the records to which the subjects are to be added, are offered.

1. Calling up a particular roll number.
2. Calling up a student by name.
3. Calling up a particular form, which will give all the students in that form, in the order in which they appear in the file.

1. By roll number-PROCfileroll

(Program listing 4-lines 1140-1330)

Each of the different methods has been given its own PROC for opening and reading the file. There is some repetition in the listings, but it leads to a program less likely to give trouble when being used.

The part of the strong record which contains the roll number is LEFT$(A$,4). This is a string, and it is therefore necessary to use the VAL function to check the numerical value of the string with the roll number required.

As when preparing the file, because we are going to WRITE back to the file when the record is altered, the function RENAME must be used. This provides an idential file, so that when the original is destroyed by the OPENOUT command, all is not lost!

1150 Copy the file under the name TEMP.
1160 OPENIN TEMP so that records may be read from it.
1170 OPENOUT List 84 (a new file) so that records may be written TO it.
1180 PY = the position of the pointer in file Y.
1190 PX = the position of the pointer in file X.
1200 REPEAT-UNTIL provides the loop.
1210 Move the X-pointer to the next position.
1220 Input the next string, A$.
1230 Check if the roll number is the one required.
1240 If it is, add the subjects.
1250 Move the Y-pointer to the next position.
1260 Print A$, either unchanged or with subjects added.
1270 Increase PY by 70, the length allotted to the string.
1280 Increase PX by 70.
1290 Continue until the end-of-file is reached in X.
1300 Close file X.
1310 Close file Y.
1320 Delete the temporary file.

2. By name-PROCfilename

The name of the student took up 24 spaces in the string:

MID$(A$,5,24)

Unless there is great care in using names, this method is likely to cause most problems when looking for a particular pupil. Because the file will contain a string 24 letters and spaces long, the name asked for must be lengthened to match. (Alternatively, the extract from the file could be shortened by removing the blanks, but adding blanks uses the PROC used in the first program). (See Program listing 5)

The PROC is a copy of the PROC which looked for a roll number, with the exception of line 1490. (See Program listing 6).

3. By Form reference-PROCfileform

PROCForm (2400-2450) is needed to endure that the form reference has exactly the same structure as the original in the file. (Program listing 7).

PROCfileform (1600-1790) is similar to PROCfilerall and PROCfilename, with the exception of line 1690 which picks up the form reference as:

MID$(A$,38,4)

As the program works through the file, each record containing that particular form reference will be picked out and offered for amendment. In practical terms, when a large number of records have to be altered, this section

CONTINUED OVER

will probably prove to be the most useful. Information is usually available for students in form groups. (Program listing 8).

OTHER PROCs

PROCWAIT	100-1030Provides the waiting time before proceeding.
PROCmessage	1040-1080The message at the top of the screen when the subjects are being added.

PROCsubjects (see Listing 9)

2500	Record$ = the string passed from the file.
2510-2530	Is the file to be amended or not? If not, record$ becomes A$ again at the end of the procedure.
2540	Any previous subjects are removed by taking the left-hand 41 characters from the string.
2550-2580	A level subjects are added until "=" is pressed.
2590-2620	O level subjects are added until "=" is pressed.
2650-2680	CEE or CSE subjects added until "=" is pressed.
2710-2760	This is the opportunity to read the subjects if they are not correct.
2770-2780	Spaces are added to fill the full length of the record.

This is perhaps not strictly necessary, but it also prevents the string becoming too long for the reserved space.

It is this section that amendments to suit a particular school should be made. For example, if you are not interested in A levels, then lines 2550-2580 are not required.

Subjects are allowed two spaces each, because the single alphabet letters are not sufficient in number. It is possible that set numbers are also important. In that case, the set number could be added after the subject so that, for example: ma2 would mean O level mathematics, set 2. Extra lines would then be needed such as: 2612 Print"Set number?":INPUT N 2614 record$ = record$ + STR$(N)

Each subject would then take 3 spaces, and this would alter later programs slightly, when lists are extracted. It would not be convenient to add sets for some subjects and not for others, without complicating later programs considerably, but I could always be used when there was only one set.

THE MAIN PROGRAM

(See Program Listing 10)

180-420 The choice of entering roll number, name or form reference.

790-990 To continue or not?

The file will now be complete with the types of information which were chosen. A lot of hard work is needed to prepare the file for the first time, but once it is complete, then the most use possible must be made from it.

At this stage, with the amount of information in the file growing steadily, it is vital that a copy of the file should be made. Since the file will take up a considerable amount of space, depending on the number of students, it is preferable that it should be on a separate disc. A copy of this disc should be made at frequent intervals, so that it is never too far but out of date. Thus if the file is accidentally erased. (WHICH CAN HAPPEN!), there is always a copy which is almost at the same stage of preparation.

In the next issue, the program which extracts lists of most kinds will be discussed. After that, a program to alter individual records, and deal with leavers. The final program will be the one that calculates the figures for Form 7.

There is an unavoidable time-lag between the preparation of an article and its publication, but the offer made in the first article still holds. If we can help with problems which arise with your file, or if you wish to add other information, please write to me at "A&B", and we will try to discuss the problems later.

POSTSCRIPT

Those versions of the BBC computer which have BASIC II have also the use of a further disc file command, OPENUP. This does not appear in the official manuals, but it does simplify some aspects of file management.

PROGRAM LISTING 1

```
2000DEFPROClist#
2010PRINT"AH Ancient History GL Geology"
2020PRINT"AR Art             GP G.P.S"
2030PRINT"BI Biology         GR German"
2040PRINT"CH Chemistry       HI History"
2050PRINT"CO Computer Stud.  LA Latin"
2060PRINT"DT Design/Tech     MA Mathematics"
2070PRINT"EC Economics       MF Further Maths."
2080PRINT"EN English         MU Music"
2090PRINT"ES Env.Studies     PH Physics"
2100PRINT"FR French          RS Religious Stud."
2110PRINT"GE Geography       TD Tech.Drawing"
2130ENDPROC
```

PROGRAM LISTING 2

```
2140 DEFPROClisto
2150PRINT"ar Art                gr German"
2160PRINT"bi Biology            hb Human Biology"
2170PRINT"ch Chemistry          hi History"
2180PRINT"co Computer Stud.     ma Mathematics"
2190PRINT"ec Economics          ph Physics"
2200PRINT"e1 English Lang.      rs Religious Stud."
2210PRINT"e2 English Lit.       ru Russian"
2220PRINT"fr French             sp Spanish"
2230PRINT"ge Geography          td Tech.Drawing"
2240PRINT"gl Geology"
2250ENDPROC
```

PROGRAM LISTING 3

```
2300 DEFPROClistc
2310PRINT"C1   Social Studies"
2320PRINT'"C2   Mathematics"
2330PRINT'"C3   Environmental Studies"
2390ENDPROC
```

PROGRAM LISTING 4

```
1140DEFPROCfileroll
1150*RENAME List84 TEMP
1160X=OPENIN("TEMP")
1170Y=OPENOUT("List84")
1180PY=PTR#Y
1190PX=PTR#Y
1200REPEAT
1210PTR#X=PY
1220INPUT#X,A$
1230IF VAL(LEFT$(A$,4)) =roll THEN 1240 ELSE 1250
1240PROCsubjects
1250PTR#Y=PY
1260PRINT#Y,A$
1270PY=PY+70
1280PX=PX+70
1290UNTIL EOF#X
1300CLOSE#X
1310CLOSE#Y
1320*DELETE TEMP
1330ENDPROC
```

PROGRAM LISTING 5

```
1100 DEFPROClength
1110 IF LEN(name$)>27 THEN 1130 ELSE 1120
1120 name$=name$+" ":GOTO 1110
1130 ENDPROC
```

PROGRAM LISTING 6

```
1400DEFPROCfilename
1410*RENAME List84 TEMP
1420X=OPENIN("TEMP")
1430Y=OPENOUT("List84")
1440PY=PTR#Y
1450PX=PTR#X
1460REPEAT
1470PTR#X=PX
1480INPUT#X,A$
1490IF MID$(A$,5,24)=name$ THEN1500 ELSE 1510
1500PROCsubjects
1510PTR#Y=PY
1520PRINT#Y,A$
1530PY=PY+70
1540PX=PX+70
1550UNTIL EOF#X
1560CLOSE#X
1570CLOSE#Y
1580*DELETE TEMP
1590ENDPROC
```

PROGRAM LISTING 7

```
2400DEFPROCform
2410IF LEN(form$)>3 THEN form$=LEFT$(form$,4):GOTO 2450
2420IF LEN(form$)>2 THEN form$=LEFT$(form$,1)+" "+RIGHT$(form$,2):GOTO 2450
2430IF LEN(form$)>1 THEN form$=LEFT$(form$,1)+"  "+RIGHT$(form$,1):GOTO 2450
2440form$=form$+"   "
2450ENDPROC
```

PROGRAM LISTING 8

```
1600DEFPROCfileform
1610*RENAME List84 TEMP
1620X=OPENIN("TEMP")
1630Y=OPENOUT("List84")
1640PY=PTR#Y
1650PX=PTR#X
1660REPEAT
1670PTR#X=PX
1680INPUT#X,A$
1690IF MID$(A$,38,4)=form$ THEN1700 ELSE 1710
1700PROCsubjects
1710PTR#Y=PY
1720PRINT#Y,A$
1730PY=PY+70
1740PX=PX+70
1750UNTIL EOF#X
1760CLOSE#X
1770CLOSE#Y
1780*DELETE TEMP
1790ENDPROC
```

PROGRAM LISTING 9

```
2490 DEFPROCsubjects
2500 record$=A$:PRINT'':record$
2510 PRINT'"Do you wish to redo the subjects?(Y/N)"
2520INPUT N$:IF N$="Y" OR N$="y" THEN 2540 ELSE 2530
2530IF N$="N" OR N$="n" THEN 2790 ELSE 2510
2540 record$=LEFT$(record$,41)
2550CLS: PROCmessage:PROClistc
2560 INPUT N$:IF N$="=" THEN 2590
2570 record$=record$+N$
2580 GOTO 2560
2590CLS:PROCmessage:PROClistc
2600INPUT N$:IF N$="=" THEN 2650
2610 record$=record$+N$
2620GOTO 2600
2650CLS:PROCmessage:PROClistc
2660INPUT N$:IF N$="=" THEN 2710
2670 record$=record$+N$
2680GOTO 2660
2710CLS:PRINT'':record$
2720PRINT''"Is this correct?(Y/N)"
2730INPUT N$:IF N$="Y" OR N$="y" THEN 2770 ELSE 2740
2740 PRINT''"You will be asked for the subjects      again."
2750FOR T=1 TO 1000:NEXT
2760 GOTO 2500
2770 IF LEN(record$)>67 THEN 2790 ELSE 2780
2780 record$=record$+" ":GOTO 2770
2790 A$=record$
2800 ENDPROC
```

PROGRAM LISTING 10

```
180CLS:PRINT"Do you know the roll number of the"
190PRINT'"record to be amended?(Y/N)"
200 INPUT N$:IF N$="Y" OR N$="y" THEN300 ELSE 210
210PRINT''"Do you know the name of the "
220PRINT''"record to be amended?(Y/N)"
230 INPUT N$:IF N$="Y" OR N$="y" THEN 400 ELSE 240
240PRINT''"What is the form reference of the"
250PRINT'"record to be amended?"
260 INPUT form$:PROCform
270 PROCfileform:GOTO 790
300 PRINT'"What is the roll number?"
310 INPUT roll
330 PROCfileroll:GOTO 790
400 PRINT'"What is the name?(in the form SMITH JONATHAN)"
410 INPUT name$:PROClength
420 PROCfilename:GOTO 790
790 PRINT''"Do you wish to amend another record?"
800 INPUT N$:IF N$="Y" OR N$="y" THEN180 ELSE 990
990END
```

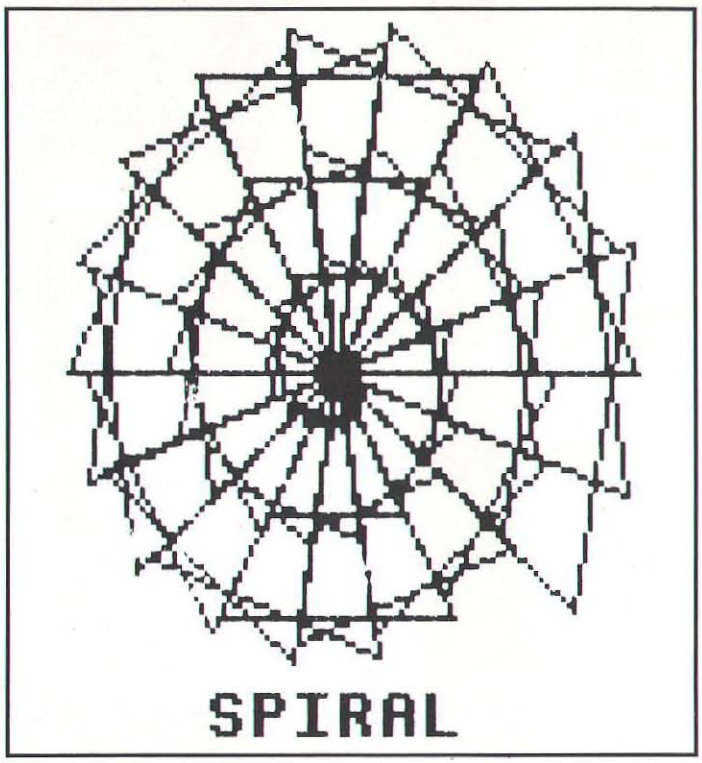
PROGRAM LISTING 11

```
1000DEFPROCWAIT
1010PRINT''"Press the space bar to continue"
1020IF GET = 32 THEN 1030 ELSE 1020
1030 ENDPROC
1040 DEFPROCmessage
1050PRINT"Type in the subject reference followed"
1060PRINT"by the return key. Type = when you are"
1070PRINT"ready to move on ."
1080 ENDPROC
```

Turtletalk

Tony Self

Come aboard as we set sail on a two part voyage into turtle graphics programing.



Turtletalk is a subset of the language Logo, invented by Seymour Papert, which allows the user, by the use of simple commands to instruct a cursor on the screen to draw graphic patterns and designs. These are commonly called "Turtle Graphics". The beauty of the language is that the user can build up a library of his own routines which use the operating system commands and/or other user defined routines, and so create complex designs in a user friendly and structured way. This BBC version allows plotting in modes 4 and 5, and makes good use of the graphic facilities available.

LANGUAGE

Turtletalk consists of 35 system commands, which can broadly speaking be split into plotting commands and operating system commands. Table 1 lists all the system commands together with their parameters and command numbers. The program is very user friendly, issuing appropriate error messages if a mistake is made or if it can not understand the information entered. In some cases errors will cause the program to revert to its lowest mode of operation — Command mode. This can be forced at any time by pressing the ESCAPE key. There are four modes of operation, Command mode, Repeat mode, Define mode and Edit mode. In Command mode all the system commands can be used. In Repeat and Define modes all the plotting commands can be used plus a sub-set of the operating system commands, which I have called the "Help" commands. In Edit mode you can only use the plotting commands.

In Define mode you can use the plotting commands to build up your own set of user defined commands. These user defined commands can be used in any operating mode, including Define mode, allowing you to incorporate your own commands in future definitions. The program will allow you to have up to fifty user defined commands in the micro's memory at any one time, although it is possible to increase this to a maximum of one hundred and twenty seven by changing the array dimensions and any checks for the maximum allowed. The program supports full file handling allowing the user to save, load and merge files or user defined commands.

The program is written entirely in BASIC, but even so the plotting speeds are acceptedly fast, especially when compared to some of the commercial programs available. The program is about 10.5K long, excluding REM statements, but because the program has been written in a well structured manner you will have a program which will run, but with limited commands after you have entered about a quarter of the listing. The structured nature of the program also enables you to debug each section as you enter it.

Before you start entering the program I will explain some of the techniques I have used to save memory and to enable the program to run as fast as possible.

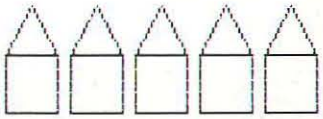
You will notice from the variable listing, that where possible I have used single letter integer variables. This saves on memory as these are stores at page &04 and do not affect the BASIC program storage area, and also these variables are accessed very quickly by BBC BASIC.

Single Byte Arrays

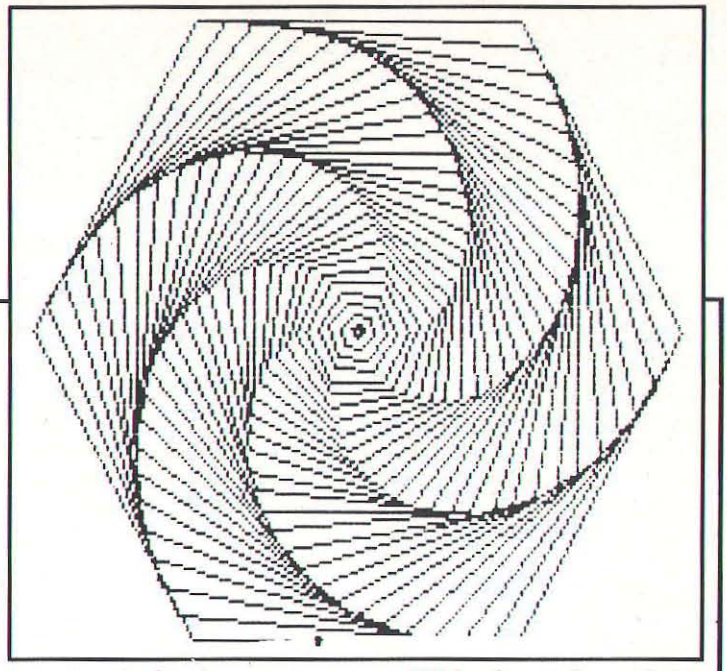
Dimensioning arrays uses up a lot of memory. Even integer arrays reserve four bytes of memory for each element. In some cases you may only need to record small values which do not exceed 256. In these cases using an integer array will waste three bytes of memory for every element which is dimensioned. To avoid this situation it is possible to design your own arrays, of which single byte arrays are the easiest to design. The DIM statement in the BBC BASIC allows a different syntax to that used for normal arrays. For example DIM E% 50 (note the lack of brackets) will reserve 50 bytes of memory and put the address of the first byte into E%. By using the indirection operator "?" we can access these memory locations. (E% will access the first byte,?E + 1) the second and so on. There is however a better syntax to do this — variable ? offset — i.e. E?0 wil access the first byte, E%?1 the second, E%?2 the third and so on. The offset can be another variable making it as easy to access this type of array as any normally dimensioned array.

Flags

I have used flags extensively in this program. The purpose of a flag is to show whether a particular state of affairs exists and normally can be expressed as simply true or false. In other words you only need a single bit to denote the situation. This means that an integer variable which is made up to four bytes or 32 bits could hold up to 32 flags. In this program I have used two integer variables to contain all the flags required. F% contains flags showing the mode of operation and K% contains flags showing the plotting mode required. Table 3 shows which bits of the variables are used and their function.



Without going into detail on Boolean logic, which has been covered in other articles, we can use the logical operators to clear and set the flags, demonstrated by the examples below:



Using OR to set the define flag —	=F% OR 1	
	Dec	Binary
Value of F%	16	00010000
OR value of bit to be set	1	00000001
Value of F% after	17	00010001
Using AND to clear the repeat flag —	F% = F% AND 253	
	Dec	Binary
Value of F% before	19	00010011
AND 255 – value of bit to be cleared	253	11111101
Value of F% after	17	00010001
Using EOR to toggle the display flag —	F% = F% EOR 16	
	Dec	Binary
Value of F% before	19	00010011
EOR val of bit to be toggled	16	00010000
Value of F% after one EOR	3	00000011
EOR value of bit to be toggled	16	00010000
Value of F% after second EOR	19	00010011

Using flags in this manner reduces the number of variables required and the use of logical operators is much quicker than adding or subtracting the required values.

Revolving Stack and Pointers

Another problem I had to solve was how to record the last few plotting positions so I could include an UNDO command in the language and also to cater for a FILL command.

I decided to record the last five positions and the obvious way was to put the information required into a series of arrays. The records are in arrays of the same name as the variables they are recording. For the FILL command they are in arrays fx(n) and fy(n), these are only used if the FILL command has been evoked. Now the problem was if I just added the new records to the top of the array and moved the older records down one position, losing the earliest records off the bottom, I would need to reassign 60 variables. What was needed was a pointer when showed in which element of the arrays the last records were kept. I therefore developed the following routines using Boolean logic again. Try defining the following function keys:

```
*KEY0 T% = T% + 1 + 5* (T% = 4):P."T% = ";T% M
*KEY1 T% = T% - 1 - 5* (T% = 0):P."T% = ";T% M
*KEY2 S% = S% + 1 + (S% = 5):P."S% = ";S% M
```

Set S% = 0 and T% = 0. Pressing f0 will add 1 to the value of T% then print the result, however when you have reached 4 the next press of f0 will revert T% to zero. This is accomplished by the expression in brackets in the definition. The expression will return −1 if true or 0 if false. So when T% = 4 the assignment of T% adds one to the value of T% then subtracts 5, the net result being T% = 0. Obviously when T% is not equal to 4 nothing is subtracted. The other function key definitions are other variations using the same idea. Pressing f1 will reduce the value of T% until it equals zero, then resetting it to equal 4. f2 adds to S% until it reaches the value of 5.

We can use T% as our pointer to which element of the array holds the last record and S% to tell us how many records we have remembered.

As you enter the program you will find other examples which use these methods.

Two Parts

Having now introduced some of the techniques I have used we can start to enter the program. Because of the length of the program the full listing is being split over two issues. The procedures and functions listed in this issue plus the extra lines mentioned in the text will give you the majority of the plotting commands plus some of the operating system commands. You will, I am afraid, have to wait for the next issue before you can start defining your own commands.

Enter each procedure or function as it is mentioned in the text. I will then explain the working of the particular routine. Once we have got to the stage of having a program which can be run, check that each new routine that has been added works before going on to the next command. Unfortunately there is a substantial amount of code to be entered to initialise the program, before you can start testing.

PROCinit — This intialises the majority of the variables and dimensions the arrays. Table 2 shows the functions of the main variables. The table does not include local variables, which will be explained as we come to them.

PROCmode — This sets the variables which are dependant on the screen mode being used.

PROCwindows —This is called by PROCmode to set the text and graphics windows after a mode change.

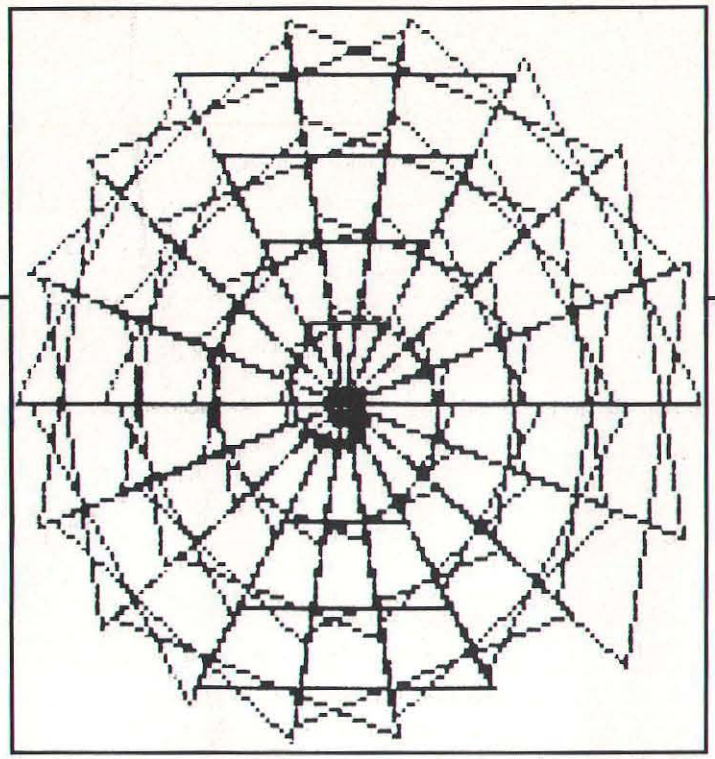
FNinput — Having now initiated the program we come to one of the most complicated routines of the program. The function starts by accepting a command from the keyboard. Only certain keys are allowed and a beep us sounded if an invalid key is depressed. The command word is terminated either by the return key or the space bar. FNfind — is then called to check whether it recognises the command number (i.e. bit 7 is set). If the command was not recognised then zero is returned. This causes an error message to be printed and a new command to be prompted.

FNcheck — is then called to see whether the command is allowable by checking the operating mode flags. If the command is prompted. Checks are then made for the UNDO command. This will be covered in the next issue. If the command does not require a parameter (see Table 1) then details are recorded for the UNDO command and the command string that has been enter is converted to the character represented by the command number plus a CHR$10. This string is then returned by the function.

If a parameter is required and the return key terminated the command word then an error message prompts for the correct type of parameter. The function then moves on to the second stage where it accepts the parameter from the keyboard. Again there are certain restrictions on which keys can be used. This section can only be terminated after entering a parameter and pressing the return key. FNfind is called again to see whether it recognises the paramater.

FNvalid — Then checks to see whether any string parameter entered is allowable, if not error message and prompt for new command. If a numeric parameter was entered we now evaluate P$ and put the value into P, otherwise we set P to zero. Unfortunately we have now used a BASIC function which is not very friendly. In BBC BASIC if EVAL can not evaluate the string expression it produces the error message "no such variable". To overcome this we have to write

CONTINUED OVER



our own error capture routine — see lines 30000 onwards. Having now sorted out our parameter we can record the details for the UNDO command and return a string from the function containing the character represented by the command number plus the parameter in full plus a CHR$10.

Before carrying on make sure you have entered all the routines mentioned so far.

PROCmsg — This short routine is used to print error messages to the screen. Two parameters are passed. The first is the error number, which also incorporates two flags. If bit 6 is set then the second parameter, a string, is tagged onto the end of the error message, whereas if bit 7 is set the string is put in front. The routine reads through the data statements until it reaches the correct one then it adds the string parameter as appropriate.

PROCchoose — This very short routine decided whether the command to be executed is a system or user defined command and then directs control to the relative procedure.

Calling The Routines

So far all we have entered is a series of procedures and functions. Before we can run the program we must enter a few lines to call the procedures and a few dummy PROC's which will be entered in full later on in the next issue.

```
120   PROCinit
130   M% = 4
1000  PROCmode
1050  C$ = FNinput:IF C$ = ""
      THEN 1050
1060  PROCchoose
1070  GOTO 1050
8000  DEF PROCundo
8010  ENDPROC
8200  DEF PROCrecord
8210  ENDPROC
10500 DEF PROCcoords
10510 ENDPROC
```

Next we will start to enter PROCsysex. This is the only procedure we will enter piecemeal adding extra lines as we add new commands. This procedure is the heart of the program and is entered at some stage by all the commands. To start with enter the following Lines:

```
5000 DEF PROCsysex : LOCAL x%, y%

5010 ON C% GOSUB 5025, 5025 . . . . .
. . . . . . . (36 of these)
5020 END PROC
5025 PRINT' (COM$)C%0;" – command""not available
     yet";:RETURN
```

This procedure works by calling a subroutine dependent in C%, the command number. At the moment we have set things up so line 5025 is called whatever the command number. This line then prints a message saying that the command is not yet available. However, we are now in a position to run the program to see whether the input routine works correctly. Having saved a tape or disc of what you have entered so far, run the program.

You should immediately get the response "CLEAR — command not yet available". This is because PROCwindows calls this command to clear and initialise the graphics screen. This should be followed by the prompt "command ". You can now go through all the commands in turn using the full command or the two letter mnemonic. You should receive a message after each command is entered either reporting that the command is not yet available or reporting an error (i.e. entering END REPEAT will give you the message "* not repeating". You can check these error messages further by adding a line after PROCinit to alter the Define and/or Repeat flags in F%.

Adding Commands

Now we are in a position to start adding the commands.

As each command is entered it will be necessary to alter one of the line numbers in line 5010, so at the end of each routine I will add the instruction "Change no(x) to line no (xxxx)", where (x) will be the position of the line number to be changed in line 5010 and (xxxx) will be the new line number.

CL – CLEAR SCREEN

Clears plotting screen and returns cursor to centre pointing right. Cancels FILL command.

FNx & FN7 — These functions return the X and Y graphics coordinates dependant on the distance and direction to be plotted.

PROCcursor — This draws a small arrow at the current cursor position using EOR plotting, if the display flag is set.

```
5030 S% = O:CLG:GOTO5050
5050 K% = K%AND175:
AG = 0:X = 0:Y = 0:MOVE-
X,Y:PROCcursor:RETURN
```

Change no.2 to line 5030

FD – FORWARD value required

Moves cursor forward in the direction it is pointing by the number of units specified in the parameter.

```
5260 PROCcursor:
X = X + FNx(P,AG):Y = Y-
+ FN(P,AG)
5270 PROCplot:RETURN
```

PROCplot — This routine actually plots any lines on the screen. A check is made to see if the FILL flag is set so that the previous positions visited can be replotted to fill the triangle. This is necessary because the plotting of the cursor would otherwise be taken into account by the operating system, causing some strange effects. When filling a check is also made to avoid the PLOT85 bug which was present in the 0.1 OS and is still to a certain extent present on the 1.2 OS. The plotting flag, K%, is used as the actual parameter of the PLOT command.

Change no.18 to line 5260

BD – BACKWARDS — value required

Similar commands to FORWARD but moves cursor backwards.

RT – RIGHT — value required

5250 P = P – P change number 19 to line 5250.

Turns cursor right through the number of degrees specified in the parameter.

```
5190
PROCcursor:  AG = AG + P:IF
AG THEN AG = 360 + (AG
MOD 360)
5200 IFAG 360THENAG = AG
MOD 360
5210 PROCcursor:RETURN
```

Change no.15 to line 5190

LT – LEFT — value required

Turns cursor left through the

number of degrees specified in the parameter.

5180 P= –P
Change no.16 to line 5180

PU-PEN UP
PD – PEN DOWN

These commands raise and lower the pen. The pens starts in the lowered position on initialisation. When the pen is raised the FILL flag is cancelled.

5060 IFK%AND2THEN RETURN ELSE K%=K%AND174:RETURN
Change no.4 to line 5060
5070 K%=K%ORI:RETURN
Change No.5 to line 5070

FL – FILL
EN – END FILL

These commands will clear or set the FILL flag. After the FILL flag has been set, starting from the current position, filled triangles will be plotted using the last three points visited.

Therefore the first draw command will only draw a line. After that triangles will be filled until a command that cancels the FILL command is encountered.
The FILL command will also lower the pen if it is not already down. END FILL cancels the FILL command, but leaves the pen down.

5080 K%=K%AND175:RETURN
5090 IFK%AND80THEN RETURN ELSEK%=K%OR81:FOR-1=OTO7:fx(I)=X:fy(I)=Y-:NEXT:RETURN
Change no.7 to line 5090
Change no.6 to line 5080

HE – HELP

This will list all the operating system commands and their two letter mnemonics. Press any key to advance the list.

5370 CLS:FORJ%=2T036:PRINT-MID$(COM$,J%*2–1,2;"-—";COM$(J%):G%=GET-:NEXT:RETURN
Change no.29 to line 5370

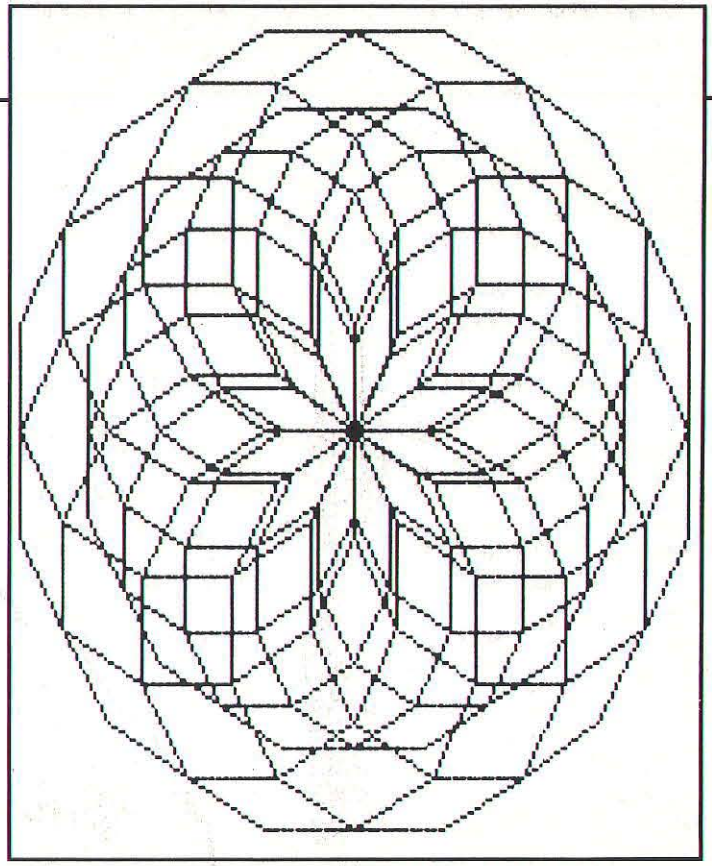
RP – REPEAT — value required
ER – END REPEAT

These commands allow you to repeat a series of commands by the number of times specified in the parameter of REPEAT. END REPEAT marks the end of the series of commands to be repeated.
e.g. REPEAT 4, FORWARD 30, RIGHT 90, END REPEAT — This will draw a square.

PROCrepeat — This procedure has two distinct sections. The first section assigns the number of repeats to ?N% and then inputs the series of commands using FNinput and puts them into D$(0,1). Each command is executed in turn. There are also checks to allow you to escape the procedure if the UNDO command undoes the REPEAT command and to avoid any "Help" commands being included in the Repeat string. The second section sets up a FOR — NEXT loop using ?N% to execute each loop. Then E%?L% is set to 1 and W%?L% is set to 0. A REPEAT loop then uses PROCextract to extract the individual commands from the Repeat string and execute them.

PROCextract — This procedure is used to extract individual commands from Repeat & User Defined Command strings. L% is used to determine the level of recursion when executing User Defined Commands. This will be explained in detail in the next issue. For the purpose of executing Repeat strings L% is always equal to zero.

As explained earlier commands are recorded in the Repeat string in the following format — command no. (this is represented by a single character whose ASCII value is that of the command number) followed by the parameter if required and then a CHR$10 to denote the end of the sequence. Our Repeat string will therefore hold a series of commands in this format. To extract an individual command from the string we can use the MID$ function. However, we need to know where in the Repeat string the command starts and its length. E%?0 has initially



been set to 1, so it will point to the beginning of the first command in the Repeat string. We can now use the INSTR function to find the first occurence in the Repeat string of a CHR$10. The value returned by INSTR will be the length of the command. We can now use MID$ to put the command into the temporary variable T$. Having done this we can now add the length of the string to E%?0 so that it now points to he beginning of the next command, ready for the next time PROCextract is called.

ASC(T$) will return the ASCII value of the first character in the command, namely the command number, which is put into C%. If the length of T$ is over 2 it must contain a parameter and if C% does not equal 23 it must be a numeric parameter, so we can evaluate the parameter and put it into P, otherwise we set P to zero. If C% equals 23 then the parameter is put into P$.

5310 PROCrepeat:RETURN
5340 IFL%=0THENF%=F%AND253:S%=0:RE-TURN ELSE RETURN
Change no.24 to line 5310
Change no.9 to line 5340

DI – DISPLAY

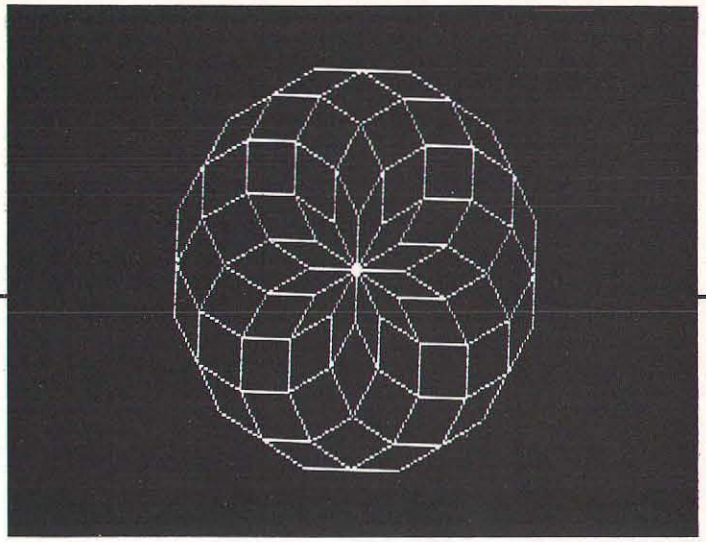
Switches cursor and coordinate display on and off.

PROCcoords — This procedure prints the updated screen coordinates across the top of the screen. t% is used to tab to the correct display position depending on the screen mode being used. This procedure is only called by FNinput if the Display flag is set.

5100PROCcursor:F%=F%EOR16:PROCcursor:x%-=POS:y%=VPOS:VDU2-8,0,31,SW%,0,30:PRINTS-PC(20*t%):IFf%AND64TH-ENVDU28,0,31,SW%28:E-LSEVDU28,0,31,SW%,26
5110VDU31,x%,y%:RETURN
Change no.34 to line 5100

After entering the commands covered in this issue line 5010 should be looking like this.

CONTINUED OVER



```
5010 ON C% GOSUB 5025,5030,5040,5060,5070,5080,
5090,5025,5340,5025,5025,5025,5025,5025,5190,5180,-
5025,5260,5250,5025,5025,5025,5025,5310,5025,5025,-
5025,5025,5370,5025,5025,5025,5025,5100,5025,5025
```

In the next issue we will finish off the plotting commands and then concentrate on the Define command and its supporting routines.

Table 1 — THE SYSTEM COMMANDS

CLEAR	CL		2
HOME CURSOR	HM		3
PEN UP	PU		4
PEN DOWN	PD		5
END FILL	EF		6
FILL	FL		7
UNDO	UD		8
END REPEAT	ER		9
END DEFINE	EN	10	
CIRCLE	CI	value	11
COLOUR	CO	value	12
CURSOR RIGHT	value	13	
CURSOR UP	CU	value	14
RIGHT	RT	value	15
LEFT	LT	value	16
ANGLE	AG	value	17
FORWARDS	FD	value	18
BACKWARDS	BD	value	19
NUMBER	NM	value	20
TURN	TR	value	21
SIZE	TR	value	22
WRITE	WR	name	23
REPEAT	RP	value	24
DEFINE	DF	name	25
EDIT	ED	name	26
DELETE	DL	name	27
DESCRIBE	DS	name	28
HELP	HE		29
LIST	LI		30
VALUES	VL		31
PALATE	PA		32
LOAD	LO		33
DISPLAY	DI		34
QUIT	QU		35
PRINT	PR		36

Table 2 — MAIN VARIABLES USED

C% : Command number (*)
D% : Number of defined commands in memory
F% : Operation mode flag — see Table 3 (*)
G% : Character got from keyboard
J%,I : Loop counters
K% : Plotting flag — see Table 3 (*)
L% : Level of recursion
M% : Screen mode
P% : Length of individual command string extracted from Repeat or Command string
Q% : Pointer or FILL memory arrays
S% : Number of plotting commands that can be undone
T% : Pointer for Undo memory arrays
V% : Logical colour for text
A%,X%,Y%,O%,OSWORD : Parameters for OSWORD call in PROCcolour
SW% : Screen width size
XL% : Scaling factor for screen mode
P : Value of numeric parameter (*)
X,Y : Coordinates of graphics cursor (*)
AG : Angle of cursor (*)
CO : Logical colour being plotted (*)
NM,NUMBER:)
SZ, SIZE :) — System variables (*)
TR, TURN :)

STRINGS

COM$: Holds the two letter mnemonics
C$: Command string returned by FNinput
P$: Command parameter (*)
T$: Command string extracted by PROCextract
CM$: Command prompt
DF$: Define prompt
RP$: Repeat prompt
PTS : Holds current prompt

ARRAYS

COM$(37) : Holds the full system command names
D$(50,1) : Holds the names and the command strings for the user defined commands
fx(7),fy(7) : Holds coordinates of last seven places visited for Fill routine
C65),S(5) : Holds values of Cos and Sin for PROCcircle

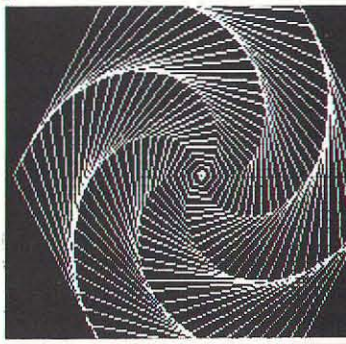
All the variables shown above marked with an (*) have corresponding arrays of the same name.

SINGLE BYTE ARRAYS

W% : Pointer to array holding Repeat or Command string
E% : Pointer to position of next command to be extracted from Repeat or Command string
R% : Pointer to beginning of repeat loop in Command string
N% : Holds number of repeats left to execute
Z% : Temp variable used in PROCedit

Table 3 – FLAGS

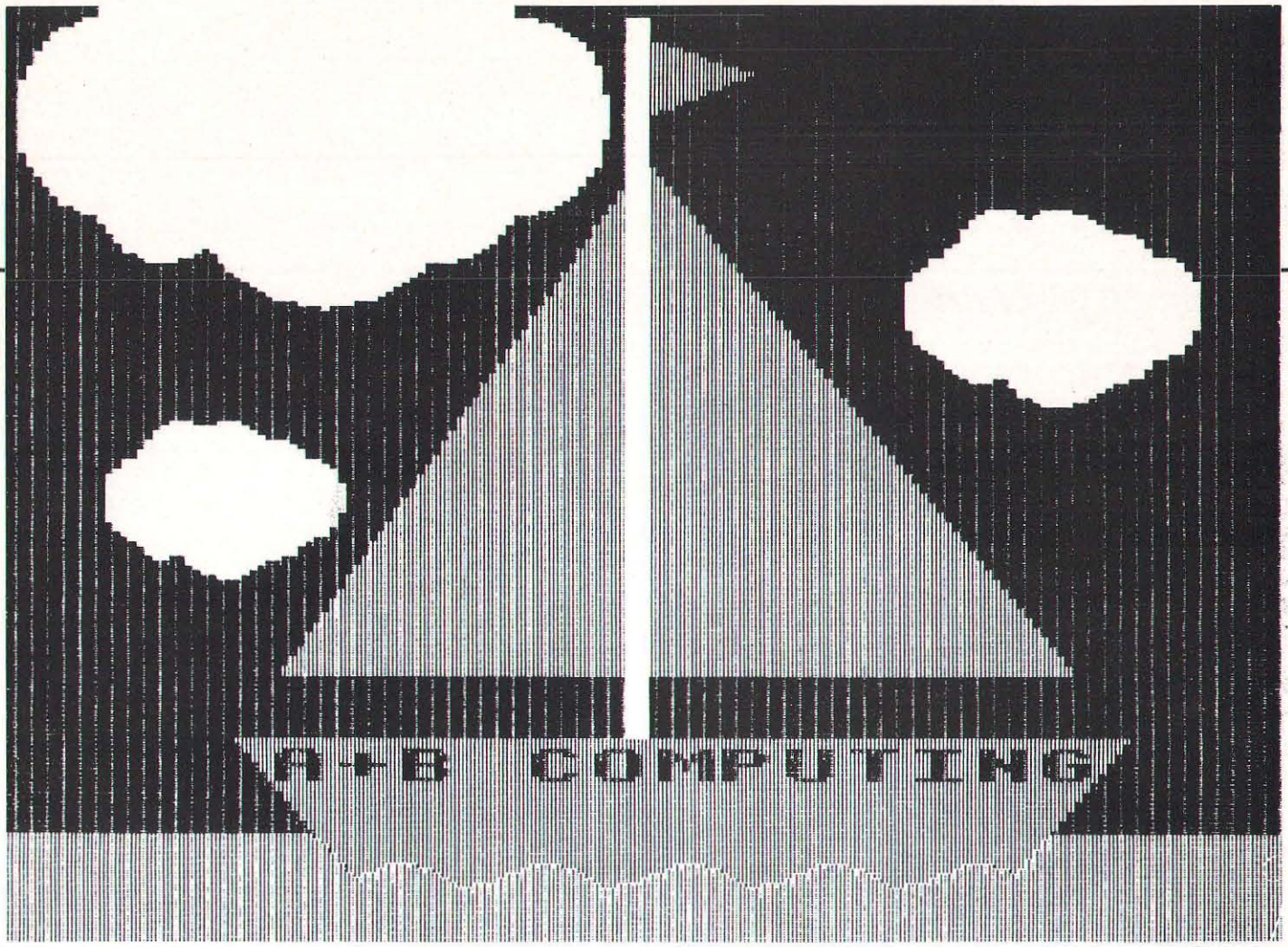
F%	: Define	bit 0 set
	: Repeat	bit 1 set
	: Display	bit 4 set
	: Edit	bit 6 set
K %		
	: Pen-up	all bits clear
	: Pen down	bit 0 set
	: Fill	bits 4 & 6 set
	: Undo	bit 1 set



PROGRAM LISTING

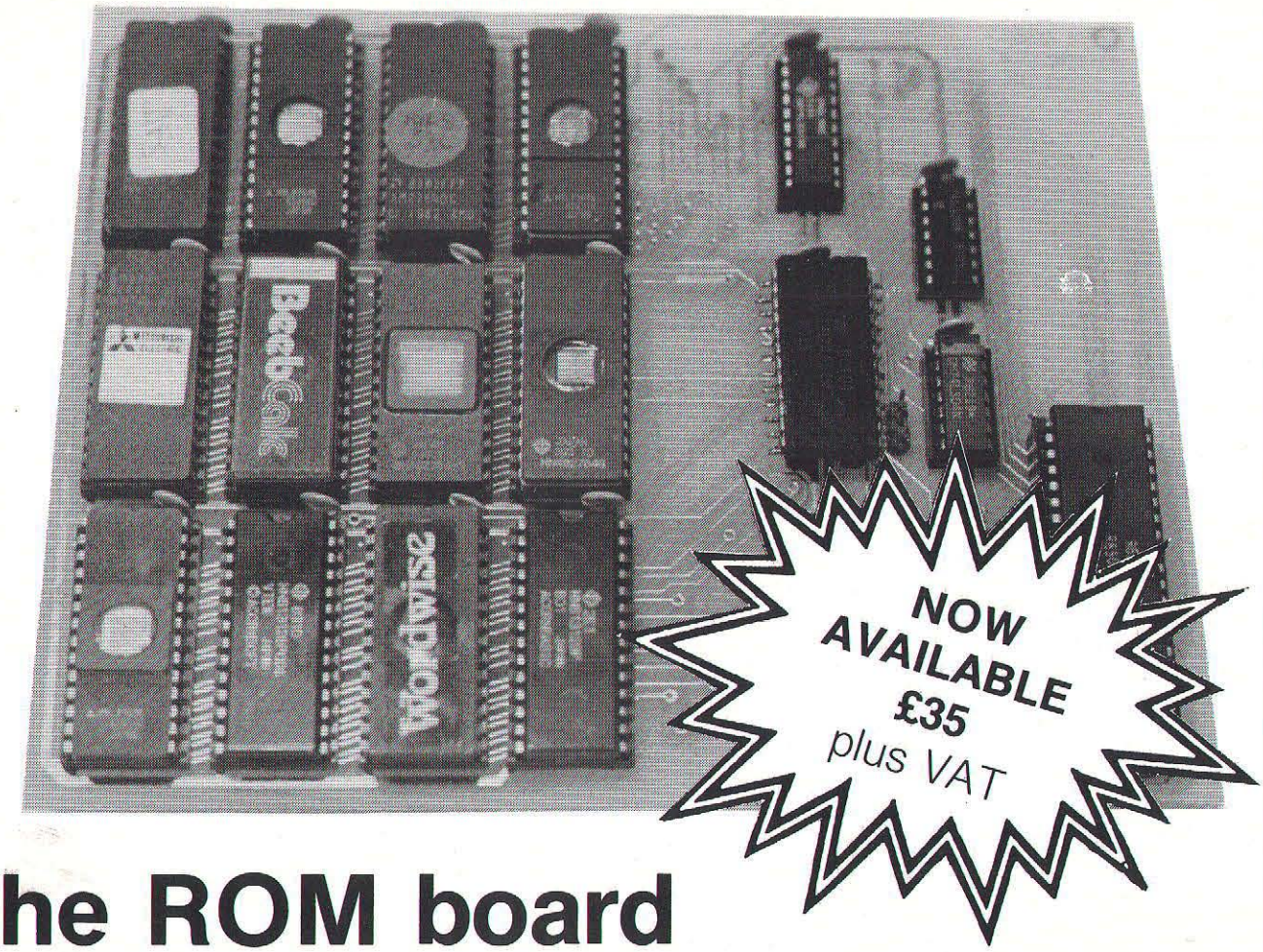
```
 6997 REM  ********************
 6998 REM  **    PROCchoose    **
 6999 REM  ********************
 7000 DEF PROCchoose
 7010 IFC%AND128 THENPROCdefex(C%) ELSEPROCsysex
 7020 ENDPROC
 7497 REM  ********************
 7498 REM  **    PROCextract   **
 7499 REM  ********************
 7500 DEF PROCextract
 7510 P%=INSTR(MID$(D$(W%?L%,1),E%?L%),CHR$10)
 7520 T$=MID$(D$(W%?L%,1),E%?L%,P%):E%?L%=E%?L%+P%
 7530 C%=ASC(T$):IFLEN(T$)>2ANDC%<>23THENP=EVAL(MID$(T$,2
))ELSEP=0
 7540 IFC%=23THENP$=MID$(T$,2,LEN(T$)-2)
 7550 ENDPROC
 8997 REM  ********************
 8998 REM  **    PROCplot      **
 8999 REM  ********************
 9000 DEF PROCplot
 9010 GCOL0,C0
 9020 IFK%AND80THEN9050
 9030 PLOTK%,X,Y
 9040 PROCcursor:ENDPROC
 9050 IFfy(Q%)<(Y+1)ANDfy(Q%)>(Y-1)ANDfy(Q%-1-7*(Q%=0))<(
Y+1)ANDfy(Q%-1-7*(Q%=0))>(Y-1) THENPLOTK%AND175,X,Y:Q%=Q%
+1+7*(Q%=6):fx(Q%)=X:fy(Q%)=Y:GOTO9040
 9060 MOVEfx(Q%),fy(Q%):MOVEfx(Q%-1-7*(Q%=0)),fy(Q%-1-7*(
Q%=0)):Q%=Q%+1+7*(Q%=6):fx(Q%)=X:fy(Q%)=Y:GOTO9030
 9070
 9497 REM  ********************
 9498 REM  **    FNx & Y       **
 9499 REM  ********************
 9500 DEF FNx(D,AG)
 9510 =(COS(RAD(AG)))*D*XL%
 9520 DEF FNy(D,AG)
 9530 =-(SIN(RAD(AG)))*D*XL%
 9997 REM  ********************
 9998 REM  **    PROCcursor    **
 9999 REM  ********************
10000 DEF PROCcursor:IFF%AND16THENGCOL3,3:ELSEENDPROC
10010 PLOT1,FNx(6,AG),FNy(6,AG)
10020 PLOT0,FNx(6,AG),FNy(6,AG)
10030 PLOT0,FNx(6,AG+150),FNy(6,AG+150)
10040 PLOT81,FNx(6,AG+270),FNy(6,AG+270)
10050 MOVEX,Y
10060 ENDPROC
10497 REM  ********************
10498 REM  **    PROCcoords    **
10499 REM  ********************
10500 DEF PROCcoords:LOCAL x%,y%
10510 x%=POS:y%=VPOS
10520 VDU28,0,31,SW%,0,30:PRINTTAB(0,0)"X=      ";B$;INT(X
/XL%*2+.5)/2;TAB(7*t%,0)"Y=      ";B$;INT(Y/XL%*2+.5)/2;TA
B(t%*14,0)"A=      ";B$;INT(AG*10)/10
10530 IFF%AND64THENVDU28,0,31,SW%,28 ELSEVDU28,0,31,SW%,2
6
10540 VDU31,x%,y%:ENDPROC
10997 REM  ********************
10998 REM  **    PROCrepeat    **
10999 REM  ********************
11000 DEF PROCrepeat
11020 F%=F%OR2:IFF%AND64THENENDPROC ELSE?N%=ABS(INT(P)):D
$(0,1)=""
11030 REPEAT
11040   C$=FNinput
11050   IFC%=24THEN11180
11060   IFC$=""THEN11040
11070   IFC%>27ANDC%<35THEN11090
11080   D$(0,1)=D$(0,1)+C$
11090   PROCchoose
11100   UNTILC%=9:IFF%AND1THEND$(D%,1)=D$(D%,1)+D$(0,1)
11110 FORJ%=2TO?N%:E%?L%=1:W%?L%=0
11120   REPEAT
11130     PROCextract
11140     PROCchoose
11150     UNTILC%=9
11160   NEXT
11170 ENDPROC
11180 UNTILC$="":ENDPROC
17997 REM  ********************
17998 REM  **    FNinput       **
17999 REM  ********************
18000 DEF FNinput
18010 IFF%AND16THENPROCcoords
18020 IFF%AND2THENPT$=RP$ ELSE IFF%AND1THENPT$=DF$ ELSE P
T$=CM$
18030 PRINT'PT$;:C$="":P$=""
18040 G%=GET:IF(G%>39ANDG%<58ANDG%<>44)OR(G%>64ANDG%<91)O
R(G%>127ANDG%<138)THEN18110
18050 IFG%=127ANDLEN(C$)>0THENC$=LEFT$(C$,LEN(C$)-1):PRIN
TCHR$G%;:GOTO18040
18060 IFLEN(C$)<2THEN18100
18070 IFG%=13THEN18120
18080 IFG%=32AND(LEN(C$)=3OR(LEN(C$)=4ANDASC(C$)=72)OR(LE
N(C$)=5ANDASC(C$)=67)OR(LEN(C$)=6ANDC$="CURSOR"))THEN1811
0
18090 IFG%=32THEN18120
18100 VDU7:GOTO18040
18110 PRINTCHR$G%;:C$=C$+CHR$G%:GOTO18040
18120 C%=FNfind(C$):IFC%=0THENPROCmsg(65,C$):GOTO18020
18130 IFFNcheck THEN18020
18140 IFC%=8AND(F%AND64)THENPROCmsg(20,""):PROCmsg(24,"")
:=""
18150 IFC%=8THENPROCundo:=""
18160 IFC%<11ORC%>128THENPROCrecord
18170 IFC%<11ORC%>28THENP=0:C$=CHR$(C%):=C$+CHR$10
18180 IFG%=32THEN18200
18190 IFC%<25ANDC%<>23THENPROCmsg(2,""):PRINT'C$;:ELSEPRO
Cmsg(3,""):PRINT'C$;
18200 PRINT" ";
18210 P$=""
18220 G%=GET:IF(G%>39ANDG%<58ANDG%<>44)OR(G%>64ANDG%<91)O
R(G%>127ANDG%<138)THENPRINTCHR$G%;:P$=P$+CHR$G%:GOTO18220
18230 IFG%=127ANDLEN(P$)>0THENP$=LEFT$(P$,LEN(P$)-1):PRIN
TCHR$G%;:GOTO18220
18240 IFLEN(P$)<1ORG%<>13THENVDU7:GOTO18220
18250 G%=FNfind(P$):IF FNvalid THEN18020
18260 IFC%<25ANDC%<>23THENP=EVAL(P$)ELSEIFC%>25ANDC%<29TH
ENP=G%ELSEP=0
18270 IFC%<26THENPROCrecord
18280 C$=CHR$(C%):=C$+P$+CHR$10
18997 REM  ********************
18998 REM  **    FNfind        **
18999 REM  ********************
19000 DEF FNfind(F$)
19010 LOCAL c%
19020 c%=INSTR(COM$,F$):IFc%/2<>INT(c%/2) THEN=((c%+1)/2)
 ELSE c%=0
19030 REPEATc%=c%+1:UNTILF$=COM$(c%) OR c%=37:IFc%<37THEN
=c%
19040 c%=0:REPEATc%=c%+1:UNTILF$=D$(c%,0) OR D$(c%,0)=""
19050 IFD$(c%,0)=""THEN=0ELSE=c%OR128
19997 REM  ********************
19998 REM  **    FNcheck       **
19999 REM  ********************
20000 DEF FNcheck
20010 IF(F% AND2)AND((C%>24 ANDC%<29)ORC%=10 ORC%=35 ORC%
=36)THENPROCmsg(4,""):PROCmsg(80,C$):=TRUE
20020 IF(F% AND64)ANDC%>25ANDC%<37THENPROCmsg(15,""):PROC
msg(80,C$):=TRUE
20030 IF(F% AND1)AND((C%>25 ANDC%<29)ORC%=35 ORC%=36)THEN
PROCmsg(5,""):PROCmsg(80,C$):=TRUE
20040 IF(F% AND2)ANDC%=24THENPROCmsg(6,""):=TRUE
20050 IF(F% AND1)ANDC%=25THENPROCmsg(7,""):=TRUE
20060 IF(NOTF% AND2)ANDC%=9THENPROCmsg(8,""):=TRUE
20070 IF(NOTF% AND1)ANDC%=10THENPROCmsg(9,""):=TRUE
20080 IFC%=25ANDD%=50THENPROCmsg(19,""):=TRUE
20090 =FALSE
20997 REM  ********************
20998 REM  **    FNvalid       **
20999 REM  ********************
```

CONTINUED OVER




```
21000 DEF FNvalid
21010 IFG%>128ANDC%=25THENPROCmsg(10,""):=TRUE
21020 IFG%=0ANDC%>25ANDC%<29THENPROCmsg(140,P$):=TRUE
21030 IFG%<>0ANDG%<128ANDC%>24ANDC%<29THENPROCmsg(80,P$):
PROCmsg(11,""):=TRUE
21040 =FALSE
21997 REM  **********************
21998 REM  **     PROCmsg     **
21999 REM  **********************
22000 DEF PROCmsg(n%,c$)
22010 LOCALm%,l%,t$
22020 m%=n%AND63:l%=0:RESTORE:REPEATl%=l%+1:READt$:UNTILl
%=m%
22030 IFn%AND128THENt$=c$+" "+t$
22040 IFn%AND64THENt$=t$+" "+c$
22050 PRINT'"* ";t$;
22060 VDU7
22070 ENDPROC
22080 DATAdon't know,value please,name please,repeating,d
efining,already repeating,already defining,not repeating,
not defining
22090 DATAalready defined,system command,not defined,I ca
n't delete,I've forgotten,editing,can't use,required by,t
hat command sorry,my chips are full
22100 DATAsorry I can't,evaluate,that colour no.,is not a
vailable,UNDO in EDIT mode
24997 REM  **********************
24998 REM  **     PROCinit     **
24999 REM  **********************
25000 DEF PROCinit
25010 DIM COM$(37),D$(50,1),W% 50,E% 50,R% 50,N% 50,Z% 2,
O% 5
25020 COM$="NOCLHMPUPDEFFLUDERENCICOCRCURTLTAGFDBDNMTRSZW
RRPDFEDDLDSHELILOVLPADIPRQU"
25030 RESTORE26000:FORJ%=1TO36:READ COM$(J%):NEXT
25040 S%=0:T%=0:Q%=0
25050 DIM C%(4),AG(4),X(4),Y(4),TR(4),NM(4),SZ(4),P(4),F%
(4),K%(4),CO(4),P$(4),fx(7),fy(7)
25060 K%=5:F%=24:L%=0:D%=0:NM=4:NUMBER=4:TR=90:TURN=90:SZ
=20:SIZE=20:X=0:Y=0:AG=0:P=0:B$=STRING$(5,CHR$8):OSWORD=&
FFF1:A%=&0B:X%=0% MOD 256:Y%=0% DIV 256
25070 DIM S(5),C(5):FORJ%=0TO5:S(J%)=SIN(RAD(9*J%)):C(J%)
=COS(RAD(9*J%)):NEXT
25080 ENDPROC
26000 DATANOTHING,CLEAR,HOME CURSOR,PEN UP,PEN DOWN,END F
ILL,FILL,UNDO,END REPEAT,END DEFINE,CIFNCLE,COLOUR,CURSOR
 RIGHT,CURSOR UP,RIGHT,LEFT,ANGLE,FORWARD,BACKWARDS
26010 DATANUMBER,TURN,SIZE,WRITE,REPEAT,DEFINE,EDIT,DELET
E,DESCRIBE,HELP,LIST,LOAD,VALUES,PALETTE,DISPLAY,PRINT,QU
IT
26997 REM  **********************
26998 REM  **     PROCmode     **
26999 REM  **********************
27000 DEF PROCmode
27010 IFM%=4THENSW%=39:XL%=4:CM$="Command >":DF$=" Define
 >":RP$=" Repeat >":t%=2:V%=1:VDU22,4:ELSE SW%=19:XL%=8:C
M$="C>":DF$="D>":RP$="R>":t%=1:V%=3:VDU22,5
27020 CO=V%:PROCwindows
27030 ENDPROC
27497 REM  **********************
27498 REM  **     PROCwindows     **
27499 REM  **********************
27500 DEF PROCwindows
27510 VDU28,0,31,SW%,26,24,0;220;1279;1023;29,642;610;
27520 C%=2:PROCsysex
27530 ENDPROC
29997 REM  **********************
29998 REM  **     ERROR ROUTINES     **
29999 REM  **********************
30000 IF ERR=26 AND ERL=18260THEN PROCmsg(20,""):PROCmsg(
85,P$):GOTO30030
30010 IF ERR=17 THEN 30030
30020 VDU22,7:REPORT:PRINT" at line ";ERL:END
30030 IFF%AND64THENVDU28,0,31,SW%,26:PRINT'"EDIT ABANDONE
D"':F%=F%AND190:GOTO30060
30040 IFF%AND1THENPRINT'"DEFINING ABANDONED"':F%=F%AND252
:D%=D%-1:GOTO30060
30050 IFF%AND2THENPRINT'"REPEATING ABANDONED"':F%=F%AND25
3
30060 L%=0:VDU29,642;610;:MOVEX,Y:GOTO1050
```

SIR ROM BOARD



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Multiple Roms

Trevor Attewell

If you are extending into the world of ROM based software then it is important to be aware of the pitfalls as well as the advantages. Here are some brief pointers to the things you should be looking for when shopping for ROM expansion boards.

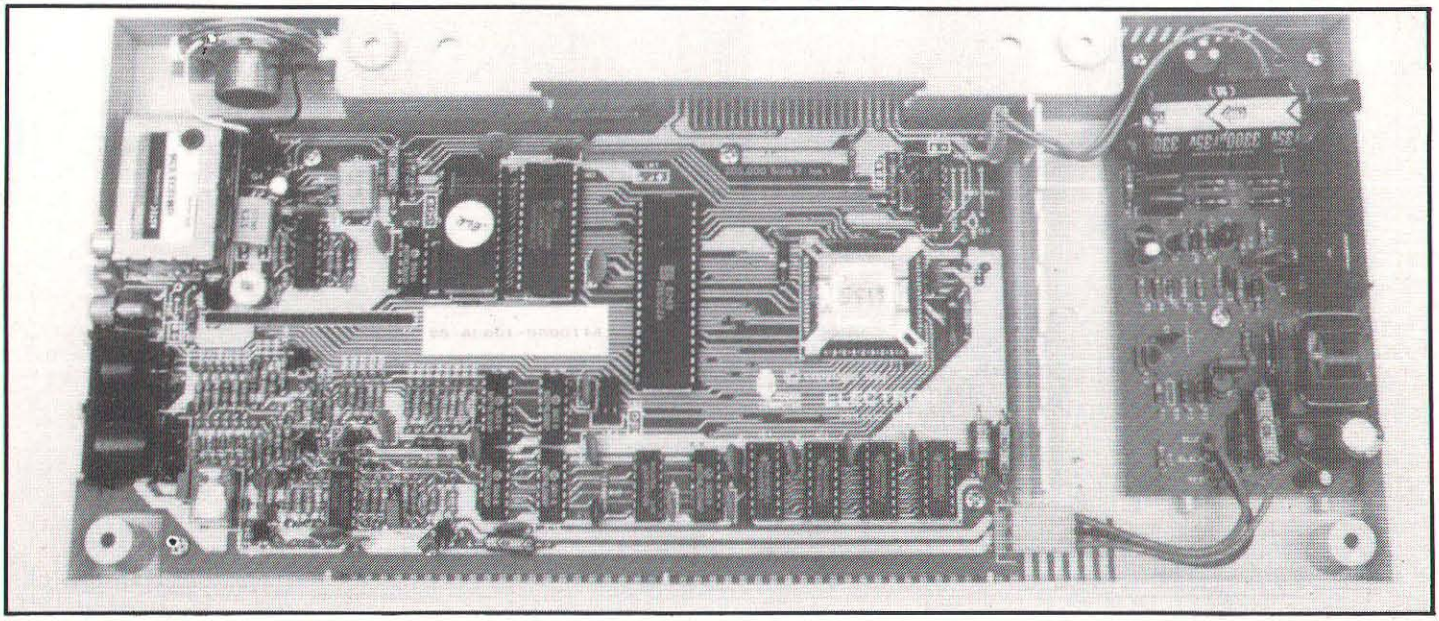
With so many Eproms available and expected, Beeb users are rapidly filling their three spare sockets and looking for more. Some are swopping ROMs around in the same sockets, but this is a chancy buisness since the sockets are of a type that can only withstand a limited number of pin insertions before trouble arises from bad contacts. Frequent removals and insertions also put the ROMs themselves at risk! The answer is to buy an extension board which will take anything up to 13 more ROMS. The 6502 can address a maximum of 16 paged ROMS, of which BASIC will normally be one.

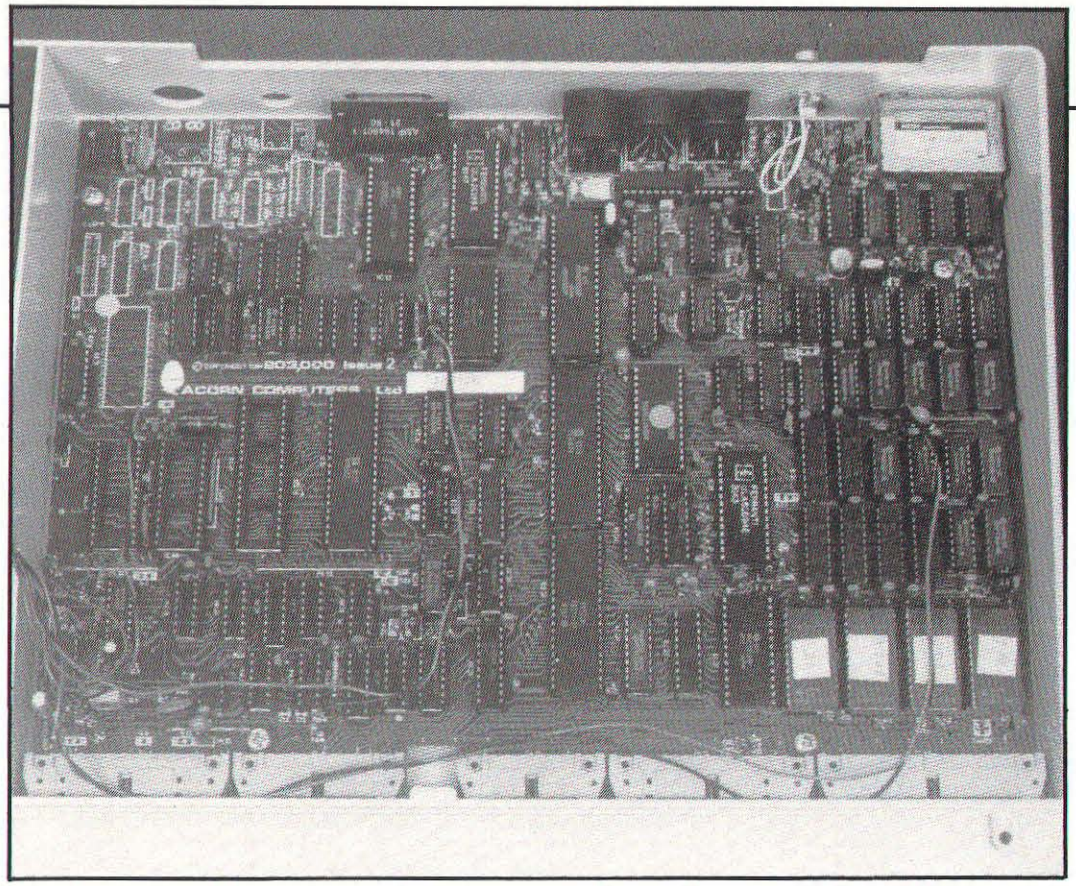
With a new expansion board appearing nearly every week, each claiming to be the best thing since crusty baked loaves, how do you choose? To review them all would be tedious and boring, not to mention totally impracticable, and the present approach is to list the desidirata for a properly designed board, so that the purchaser is suitably forewarned.

THE RUDE MECHANICALS

An awful lot of problems (for the user) lurk under this heading. First look at the size and shape of the board — what will it rest on and what will it hide? It won't be too clever if it covers all or parts of the existing free sockets, making them very difficult to use, or if it fails to clear non-robust obstructions, such as board power connections, tailer discrete components, or switch links. Nor should it unduly restrict air circulation around the hotter ICs, particularly the video ULA (with the heat sink on top). Next look underneath at its connecting pins. If these are thin, as on IC holders intended to be soldered, they can be a devil to insert without buckling, and any mechanical stresses, for example when inserting ROMs, will almost certainly lead to contact problems. Neither are very big pins a good idea — these will force open the sockets into which they are inserted so that they will no longer be useable for their original purpose, should you take the board out later. The optimum is a turned pin which looks fairly thin but resists reasonable bending pressure by a finger tip.

Soldering is the next headache — you may have to solder trailing wires on to the pins of an IC, for example. This isn't difficult *if* you have had a reasonable amount of practice, the trick being to do the job quickly (not *too* quickly) with a miniature, hot, clean iron. Most ICs are rated for soldering at 300°C for 10 seconds, but a clean, bright joint should take only half this time. If you are asked to insert a new IC as part of the expansion, make sure that it does not replace one already soldered into the comupter, because you will need a special desoldering tool plus skill in using it if you want to avoid a butchering job. You will also have to remove the mother-board from the computer first! Unless absolutely confident of your expertise let the vendor do it for you — any subsequent problems should then be down to him! Alternatively, find a board that requires no soldering. Finally check the board for general quality of components and workmanship. Professional boards should be glass-fibre based, with clean-cut, neatly laid out copper conductors, and protected by varnish. Ask how many insertions





the sockets are good for — some cheap sockets cannot be guaranteed for more than a few insertions. You may not be constantly changing your ROMs, but it's nice to know you can if you want to!

GET BUFFERED!

As far as the electronics are concerned a lot of board-buyers may be somewhat in the dark, but you can always ask questions, making it clear that you are buying specifically on the basis of the answers given. Although it may be unlikely, you should check whether the board in question involves any compromise in overall system operation, and whether there are any limitations on the number or type of ROMS it will take. A look at the instruction booklet is always useful if practicable. Check whether the address *and* data busses are fully buffered. What does that mean? A 'bus' is a set of wires that conveys signals to more than one destination, the receiving devices being paralleled. The 6502 indicates the device with which it wishes to communicate by signals sent down the address bus, and similarly it both sends and receives data from the various devices on the data bus. All computer logic is binary, relying on one voltage to indicate '1' and another to indicate '0', the nominal levels being commonly +5V and 0V. Now the sending logic device will usually have to supply current when it goes 'high' (to +5V), and may have to 'sink' (or take in) current when it goes low. Because of resistance in the inputs and outputs of logic devices this current flow will change the voltage levels (Ohm's law), so we must build in some tolerance. Thus we might design the logic so that any voltage greater than +3V would always be recognised as '1' and less than 1V as '0'. This fixes the maximum number of logic devices that can be addressed in a given configuration before the voltage levels fall outside our tolerance, always assuming the worst combination of circuit (and logic) conditions. The number in question is called the fan-out.

To increase the fan-out we use a buffer which, to put it somewhat crudely, takes in the still recognisable, if somewhat degraded, logic voltage levels from the source and restores them to their pristine states before sending them out again on a fresh bus. Thus one source could drive 10 buffers, each in turn driving another 10 (100 in all) — and so on.

This is just to illustrate the principle, of course. In the case of the BBC machine, the 6502 is buffered from RAM, but must drive everything else (even the Tube), and including all paged ROM, so that the buses are already pretty well loaded. Quite apart from current loading, the bus extensions into the expansion board and the ROMs connected to it also add capacitance, and unless they are buffered this might slow down the pulse edges and could add to propagation delay. Any problems due to bus loading or edge degredation are likely to be sporadic, depending on a variety of special factors, and will appear very obscure. Thus it is good engineering practice, putting the matter at its lowest, to buffer both address *and* data busses on any extension board — I am given to understand that not all are so buffered.

Worries have also been expressed about the loading of the +5V line. An EPROM typically requires about 40mA from this line, so the extra 13 are going to demand roughly half an ampere. If you are already powering two disc drives and a few other bits and bobs from the PSU socket, then you may well be in trouble! Again, it is good practice to provide separate power supplies for all external goodies — the PSU will run cooler (and hopefully last longer), and the extra ROMs should not then be a problem.

There is also some choice of facilities in expansion boards. Some offer paged RAM, for example, but remember that this cannot be used as a simple, straightforward extension to existing memory, being useful mainly for strong programs or data out of the way. Other facilities may include the ability to use 4K ROMS in selected sockets, and so on.

OVER TO YOU

In this article I have tried in a very general way to indicate what constitutes good practice and where possible future problems could arise. I do not claim, or wish to imply, that any product not built to these standards will ever actually give trouble, but hope that this overview will help users to make a more informed choice from a bewildering list of alternatives. To forestall any enquiries for a specific recommendation I will merely state my personal choice, which was the A.T.P.L. 'Sidewise'. This happened to be the first one examined that appears to fulfill all the requirements listed above, needs no soldering and requires only that the installer is limited to a single thumb per hand (or preferably a shade less!). It has some useful options, including battery back-up for paged RAM, the latter at slightly higher cost. But do check 'em all out for yourself!

Call To The Machine

N.S. Kirkby

We explain the use of CALL with parameters while processing BASIC variables using machine code.

Page 446 of the User Guide for the BBC micro gives a program demonstrating the use of the CALL keyword with an integer parameter. This article extends this to cover an integer array and a string array. Hints are given to allow you to extend further to cover a string, and a floating point variable. It is equally applicable to the Electron in principle although I am not familiar with its guide so its example of CALL with a parameter (if any) may be different.

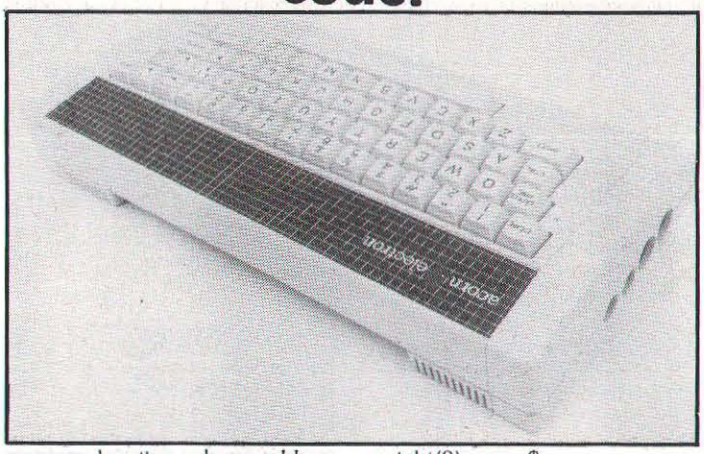
The CALL keyword is used in a statement in a BASIC program (or as a command from the keyboard) to execute a machine code program. It must be followed by a number (in hex or decimal) which is the address in memory of the code which is the entry point to that program (normally the first code). The effect is that the execution of the BASIC program jumps to that address, executes the machine code program there, and (provided that program ends with RTS) a return jump is made to the BASIC program whose execution continues.

With this simple form of the CALL keyword, the assembler (and therefore the machine code which it assembles) cannot have full access to BASIC variables. A machine code program can *input* the value of BASIC variables but cannot *output* values to them. It is sometimes important to be able to process BASIC variables using machine code because of its speed. For example, if you wanted to encrypt a long piece of confidential text, or alter thousands of numbers. It is as though there is no return channel of communication between machine code back to BASIC as far as BASIC variables are concerned. The following lines:-

quantity% = 300 in BASIC, and

LDA #quantity% in assembler

loads the Accumulator with the value of the BASIC variable "quantity%". But you cannot store a value into "quantity%" from machine code. The statement "STA quantity%" looks as though it does the trick, but in fact the program will go to the memory location whose *address* is 300 (location 300 is part of the 6502 stack!) and store the content of the Accumulator into it. This is totally different from loading the *value 300*. The only way you could get the machine code program to alter BASIC variables is to execute:-



STA &70

(or use some other suitable address in RAM) every time the machine code program wanted to vary "quantity%". Then, when BASIC wanted to use "quantity%", you would need to execute:-

quantity% = ?&70

within BASIC. This is cumbersome, consumes memory space in the text of the BASIC program and slows it down. It is a pity that the 6502 microprocessor cannot handle an instruction such as "STA #quantity%". However, this is where CALL with parameters comes to the rescue. Here is an example of it in its most complex form:-

CALL &D01,G%,quantity%, exchange_rate,staff_no%(0), weight(0),name$, surname$(0)

What this means is this. "&D01" is the address, as usual, of the entry point of the machine code, and the seven following things are BASIC variables which in this example are: a "resident" integer variable; an integer variable; a floating point (ie, decimal) variable; the first element of an array of integer variables; the first element of an array of floating point variables; a string variable; and the first element of an array of string variables. (All but the first would have to have been previously created by the BASIC program). A typical CALL statement in a program would of course only be followed by a few parameters.

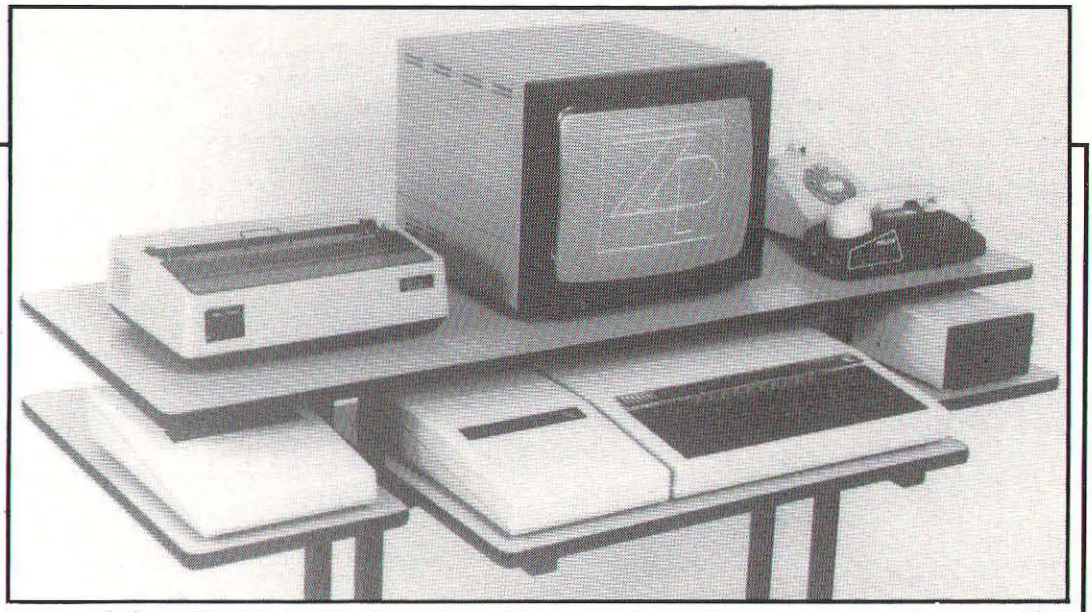
POKING THE PARAMETER

The demonstration program on page 446 of the BBC User Guide caters for the first type of variable ("resident" integer). The following is an expanded explanation of that on pages 214 to 215 and 446 to 447. If there are any parameters (ie., variables) following the CALL statement, data is automatically poked into RAM starting at address &600. (There is no choice on that address). Assuming one "resident" integer variable, page 214 shows that location &600 contains the number of parameters, (one) and &601 (low byte) and &602 (high byte) contain the address of the first of *four* locations (this is an integer remember) where is stored the value assigned to that variable.

Since you (the programmer) now know where in memory the value assigned to that variable is stored, (ie., the address starting at that pointed to by &601/&602), you can write some assembler statements to process that value. For example, you could cause it to be increased, made negative, zeroed, compared to another variable, etc. The point is that without the ability to include parameters after the CALL statement, you would not know where in memory the values of variables are stored. This is because BASIC, being a high level language, hides such technicalities from the user to make life simpler.

To put it another way, when a parameter follows a CALL statement, BASIC says to you (the programmer) "the value assigned to that variable is stored at an address (and the next three) contained in addresses &601/&602,". The demo program on page 446 includes lines 140 to 180 which are not necessary for understanding CALL with parameters, so you can ignore them. Lines 190 and 200 copy the contents of locations &601 and &602 into two locations in the zero page part of RAM (the variable ZP has the value &80 from line 110, so the copying is done onto locations &80 and &81). Zero page is used for speed of access.

Line 210 loads the two registers of the 6502 microprocessor with value so they will act as counters (indexes). Y points to the first (zeroeth) byte of the variable and X to the fourth. (Remember to count 0,1,2,3). Line 220 uses pre-indexed indirect addressing and post-indexed indirect addressing to swap the first and last bytes of the



variable A% so it ends up as &78345612. (The use of the variable A% is confusing. It is not connected here with the Accumulator. Any resident integer variable could be used).

Page 214 states also that if there is more than one parameter following the CALL statement, they will have their data poked into RAM after the data for the first. That is, into &604 onwards. If you wanted to "vandalise" those as well (assuming they were "resident" integers also) you would merely repeat the assembler instructions described above but using locations &604 onwards.

But what if you want to process the other six types of variable? Page 215 hints that the data for them is stored slightly differently but no examples are given. If the variable is a floating point variable, the address pointed to by &601/&602 (or &604/&605 etc. if there is more than one variable) is the first of *five* locations (not four). This is because floating point variables need five bytes to contain their values.

So all you need to do is write assembler statements which process five bytes. However, you need to know how floating point numbers are stored. (See Appendix 4 of "Assembly Language Programming for the BBC Microcomputer" by Ian Birnbaum; the Macmillan Press Ltd., 1983). Briefly, the five bytes are set out (in the order in which they appear in memory) as exponent, most significant byte (including the sign bit), the next byte, and the next byte, and least significant byte.

STRINGING TOGETHER

But what about integer *arrays*? Well, the values assigned to their elements are stored in a BASIC program one after the other without any gaps. The four bytes holding the value of the first (ie., the zeroeth) element are held at an address pointed to by &601/&602 (assuming that the array is the only, or the first, variable after the CALL statement). That is the same as before. So you know where that is.

The value of the next element (no. 1) is stored in the next four bytes, and so on. Therefore, you know where they are and can write assembler statements to access them. Of course, an array consists of many elements, so which one do you put after the CALL statement? The answer is the first (staff_no%(0)).

Now for strings. These are more complex because in addition to the usual address of the text assigned to the string, a string has other data associated not relevant to a single variable. For example, the current length of the string and the length allocated to it in memory. (These are the only ones which interest us as far as CALL is concerned). To cater for this, addresses &601/&602 point not to the address holding the text of the string, but to a string information block. This is simply a section of memory set aside by BASIC to store the value (ie., the text and the extra data mentioned above.

To illustrate this, lets look at string arrays. These have their data stored in a manner which is an amalgam of that for integer arrays and strings. Addresses &601/&602 (or &604/&605 etc. if there are more than one string array) point to the address of the beginning of the string information block (or blocks). The first and second locations of the string information block point to the address of the first character of the first element of the array; the next (ie., the third) contains a number equal to the length (i.e., number of memory locations) allocated to the string element; and the fourth contains the current length of the element which could be less than the allocated length). The fifth to eighth bytes in the string information block cover in similar fashion the second element, and so on for all the elements of that array.

PROGRAM EXAMPLE

This is rather complex to grasp so the program listing should help. (Electron owners should alter line 40 to MODE 6). It will show on the screen the contents of the various locations in the string information block mentioned above with a commentary. It also actually CALLs (with a parameter) a piece of machine code which modifies each of the three elements (by changing them to lower case) by way of example. The machine code follows the same pattern as that given on page 446 of the BBC User Guide.

The program is designed to be mainly self-explanatory when RUN but the following comments may help. For consistency's sake I have kept to the same name ("ZP") for the zero page locations mentioned in lines 190 and 200 of the program on page 446 of the BBC User Guide, but have used in addition "ZP-1" to show the first byte of the parameter block mentioned on page 214.

The addresses given by "sib/sib + 1" etc are "dynamic". That is, the program calculates the actual addresses which will inevitably vary with the setting of PAGE you use (which will in turn vary depending on whether you have discs and/or Econet), or if you change the length of the text of the program. In the same way the number "xx" in the line on the screen "Print the xx bytes starting" will also be the actual combined allocated lengths of all the array elements. So "xx" will naturally vary if you change the strings of the array in such a way that their lengths change significantly. In fact, you should alter lines 70 to 90 so that the element strings are sometimes less than 8 characters and sometimes more than say 16 characters long, and watch the "sib" values change. Re-RUN the program each time of course.

Note from the screen display that the characters of the string elements are packed together, one element following the previous one without the character &D (for "return") at the end of each element. So you cannot PRINT an element from BASIC by executing "PRINT aaaa", where "aaaa" is the address of that element formed from, eg., "sib/sib + 1". Note also that the characters printed on the fourth last line on the screen will contain spaces after the strings (eg., "ANDERSON ") if you have just switched on your computer, but those spaces will be replaced by odd

CONTINUED OVER

```
PRINT THE ORIGINAL STRINGS FROM BASIC:-
ANDERSON STEPHENS SIMON
Print the valuesin hex  of locations
      zp-1      zp      zp+1     zp+2 :-
       1       47       24       81
Form a parameter address from zp+1 and
zp:-      2447
(This is the address (call it "sib") of
the "String Information Block"
on page 215 of User Guide)
Print the valuesin hexof locations
sib+0 +1 +2 +3 +4 +5 +6 +7 +8 +9+10+11
  4 25 10  8 14 25 10  8 24 25  5  5
The start addresses of the array
elements are2504 2514and2524
No. of allocated bytes=sib+2,+6,+10 and
the current lengths=sib+3,+7,+11

Print the 37 bytes starting
at "first_start_addr"(2504)CHR$137 :-
ANDERSON^^^^b^^ STEPHENS1^ ^ P=1SIMON

Now modify the string there by CALLing
"modify", and reprint from BASIC:-
anderson stephens simon        Q.E.D!>
```

characters if you previously assigned other names to the elements in lines 70 to 90. In particular, upward arrows have been inserted to indicate "characters" outside the ASCII range which can cause difficulties if printed.

Finally, strings (as distinct from string *arrays*). Assuming for simplicity only one string after the CALL statement, the data for that string would appear in the program listing in the position otherwise occupied for the data for the first string element of the array described above. That is, sib/sib + 1 give the address of the first character of the string; sib + 2 the allocated length; and sib + 3 the current length. You might like to ammend the program listing to demonstrate strings. Try assigning characters to a string (say "word$) in a new line 95; modify DEF PROCprint to print only that string; and in line 270 make the variable "total_allocated_lengths" equal only to sib + 2.

This should provide the basis for further experimentation which is by far the best way to gain programming skills. You could modify the program listing to make it demonstrate all the seven different types of CALL parameters.

PROGRAM LISTING

```
  20 REM Demo. of CALL with a string array parameter.
  30 @%=8
  40 MODE 7:REM MODE 6 for Electron.
  50 DIM B$(3)
  60 PROCinit
  70 B$(0)="ANDERSON"
  80 B$(1)="STEPHENS"
  90 B$(2)="SIMON"
 100 PRINT"PRINT THE ORIGINAL STRINGS FROM BASIC:-"
 110 PROCprint
 120 PRINT
 130 CALL begin,B$(0):REM Sets up the paramater block
and zero page.
 140 PRINT"Print the values"CHR$130"in hex"CHR$137"of
locations"'TAB(6)"zp-1" TAB(15)"zp" TAB(22)"zp+1" TAB(3
0)"zp+2 :-"
 150 PRINT CHR$131;:FOR J%=zp-1 TO zp+2:PRINT~?J%;:NEX
T:PRINT
 160 PRINT"Form a parameter address from zp+1 and"'"zp
:- ";
 170 sib=?(zp+1)*256+?(zp)
 180 PRINT CHR$131 ~sib
 190 PRINT"(This is the address (call it ""sib"") of"'
"the ""String Information Block""'"on page 215 of User
 Guide)"
 200 PRINT"Print the values"CHR$130"in hex"CHR$135"of
locations"'"sib+0 +1 +2 +3 +4 +5 +6 +7 +8 +9+10+11"
 210 @%=3
 220 PRINT CHR$131 ~?sib;
 230 PRINT CHR$131;:FOR K%=sib+1 TO sib+11:PRINT~?K%;:
NEXT:PRINT
 240 PRINT"The start addresses of the array"'"elements
 are"CHR$131 ~?(sib+1)*256+?(sib),~?(sib+5)*256+?(sib+4
)"and"CHR$131 ~?(sib+9)*256+?(sib+8)
 250 first_start_addr=?(sib+1)*256+?(sib)
 260 PRINT"No. of allocated bytes=sib+2,+6,+10 and"'"t
he current lengths=sib+3,+7,+11"
 270 total_alloc_lengths=?(sib+2)+?(sib+6)+?(sib+10)
 280 @%=3:PRINT' "Print the"total_alloc_lengths" bytes
 starting"'"at ""first_start_addr""CHR$131 "("~first_s
tart_addr")CHR$137 :-":@%=8
 290 FOR L%=first_start_addr TO first_start_addr+total
_alloc_lengths-1:IF ?L%<32 OR ?L%>126 PRINT"^"; ELSEPRI
NT CHR$(?L%);
 300 NEXT:PRINT
 310 PRINT'  "Now modify the string there by CALLing"'
""modify"", and reprint from BASIC:-"
 320 CALLmodify
 330 PROCprint:PRINT TAB(30)"Q.E.D!";
 340 *KEY8FOR L%=first_start_addr TO first_start_addr+
total_alloc_lengths-1:PRINT CHR$(?L%);:NEXT|M
 350 END
 360 DEF PROCinit
 370 DIM Q% 100
 380 FOR C=0 TO 2 STEP 2
 390 par=&600:REM Parameter block. Value may be differ
ent for Electron.
 400 zp=&80:REM Usable zero page.     "     "    "
 "        "       "
 410 P%=Q%
 420 [OPT C
 430 .begin LDA par:STA zp-1 \ Number of parameters. (
=one).
 440 LDA par+1:STA zp    \ Store lobyte of string info.
 block. (="sib")
 450 LDA par+2:STA zp+1 \ Store hibyte of string info.
 block. (="sib")
 460 LDA par+3:STA zp+2 \ Store parameter type.
 470 RTS                \ Return to BASIC.
 480 .modify LDY#1:LDX#0
 490 LDA(zp,X):STA zp+3 \ Store lobyte of "first_start
_addr"
 500 LDA(zp),Y:STA zp+4 \ Store hibyte of "first_start
_addr"
 510 INY:LDA(zp),Y      \ Get first allocated string l
ength. (="sib"+2)
 520 CLC                \ Clear the carry.
 530 INY:INY:INY:INY:ADC(zp),Y  \ Add second allocated
 string length. (="sib"+6)
 540 INY:INY:INY:INY:ADC(zp),Y  \ Add third allocated
string length. (="sib"+10)
 550 STA zp+5           \ Store "total_alloc._lengths"
.
 560 LDY#0              \ Set loop counter.
 570 .loop LDA(zp+3),Y  \ Get a character from the str
ings.
 580 ORA#32:STA(zp+3),Y \ Convert to lower case and pu
t it back.
 590 INY:CPY zp+5       \ End of strings?
 600 BNE loop           \ If not, loop again.
 610 RTS                \ Return to BASIC.
 620 ] NEXT
 630 ENDPROC
 640 DEF PROCprint
 650 FOR N%=0 TO 2
 660 PRINT B$(N%)" ";
 670 NEXT
 680 ENDPROC
```

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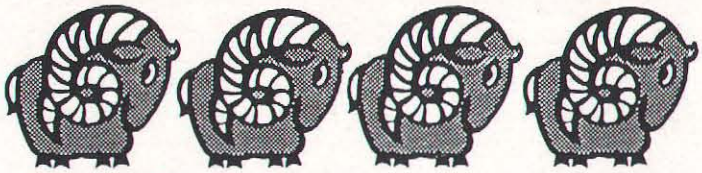
The Aries Expansion

Jeremy San



New hardware for your BBC Micro which is truly memory expanding.

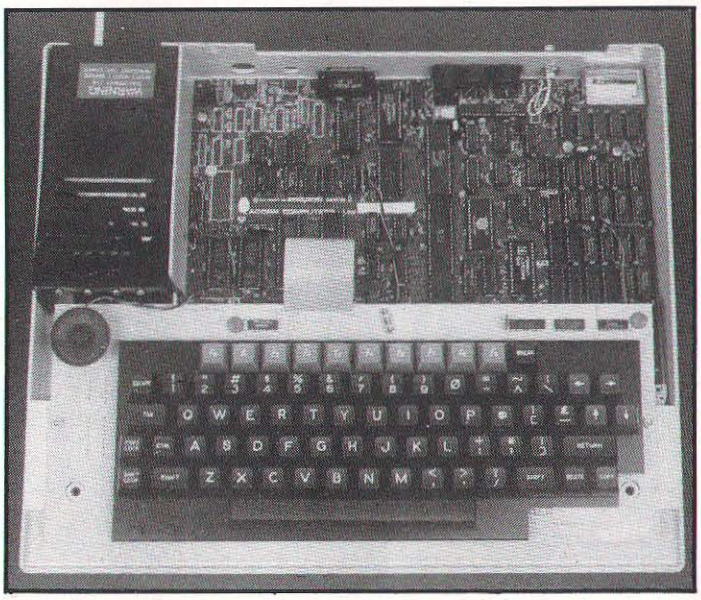
The BBC Micro is well known for its amazing graphics capability and versatile operating system, but unfortunately, is equally well known for the high memory that these unique facilities take up. In fact, the average graphics program in a 32K BBC model B computer, only has an effective 7K of memory space, because MODE 2 graphics requires a collosal 20K of memory. This is the only defined screen mode available that caters for all 16 of the graphics colours at the same time, and therefore, is the most widely used.

The BBC machine is now being extensively used in business applications. The machine is well suited for word processing tasks, but 16K of memory is used up, in order to display the 80 column screen. Therefore there is not much memory available for your text. Luckily, a company has designed a plug-in solution. It is known as 'Aries B20', and hails from Cambridge Computer Consultants Ltd.

HARD TO BELIEVE

When I first saw their advert, the caption said 'Add 20K to your BBC micro in 5 minutes.' I found this quite hard to believe because I knew that no software would be compatible unless they had done something very clever. Their claim is a bit misleading because it only adds 1K of memory to the BBC — what it *does* do, is allow full use of the exisiting 20K, that was previously used by the graphics screen memory. No clear mention of this is given in their advert, although to be fair, it is stated in their hand-out literature.

The Aries is a small green PCB about 5 inches by 2 inches. It sits directly on top of the 6502 socket, in the middle of the BBC machine. Installation proved quite easy, unplugging the 6502, then inserting it on the Aries board, then simply inserting the Aries into the recently vacated-socket on the BBC board (in fact, removing my ROM extension board proved much harder by comparison!) A sideways ROM, containing all the extra operating system software. must also be inserted into a spare ROM socket. The ARIES does not physically fit into the same space as any of the currently available ROM extension boards (ATPL, Sir, Watford etc), so the guys at Cambridge Computer Consultants are designing their own one to complement their RAM board.



The time came to power up the machine. I was slightly amused because their special software in ROM had caused the machine to say 'BBC computer 52K' instead of our old familiar message. The 52K is slightly misleading, but only as false as the old BBC saying 32K. The manual states that HIMEM (the top of memory pointer), will always stay at &8000, regardless of which screen mode was selected. Sure enough, on typing MODE 0, and then PRINT HIMEM, it displayed &8000. It was true. The ARIES ensures that free RAM is always at the maximum value. This represents around 28K free at all times.

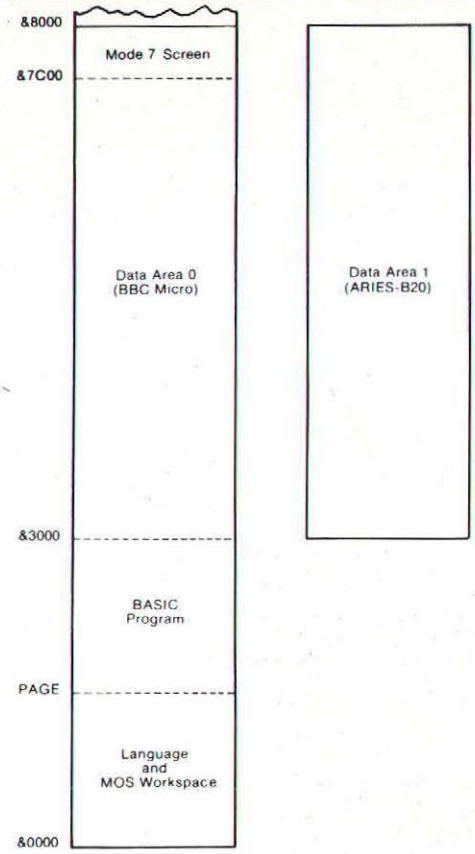
The ARIES operates by holding an extra 20K of PAGED RAM internally. The ARIES RAM is selected by writing any byte to &FFFF, and the BBC micro RAM is selected by writing to &FFFE. This is handled automatically by the ARIES operating software, and so the ARIES ensures that all BBC micro RAM is used by your own software, and that the ARIES RAM is used only for the screen memory. This is a useful arrangement, but what can be even more useful is if special software is written that detects ARIES being present in the machine, and if so, uses the 20K extra RAM of it's own accord. In this manner, a full 47K of RAM would be available to the program. That size of memory would enable high speed programs eg SPELLING CHECKERS, to make full use of available memory. The ARIES has been given an official OSBYTE (*FX) call from Acorn, *FX111,x. Where x is a number that controls the various ON/OFF states that Aries can accomodate. Unless speed is critical in paging the different RAM banks, it is suggested to use the *FX call rather than poking the board directly at locations &FFFE and &FFFF.

THOUGHTFUL DESIGN

The ARIES software is cleverly designed. It will trap all official screen accesses (eg, printing a character) and will swap it's RAM with the BBC's own RAM temporarily. It does this for enough time to put the character in it's new screen memory, and will then swap back before it is noticed by any software. Using this method, the RAM swapping technique is totally transparent to all software, and this gives a very effective way of increasing the BBC micro's memory to its true internal lines.

Some software available, notably arcade games, will require the ARIES to be disabled, because they will want to POKE the screen directly to display fast animated graphics. In this case, ARIES provides two special star commands to accomodate switching it on and off. These are XON and XOFF respectively. They are an unusual choice of commands, because they are terms used in the handshaking of serial communications. I disliked the fact that on every 'hard break' (pressing CTRL and BREAK together), the ARIES defaulted to it's ON position, I would have preferred it to turn OFF on a hard break, and only turn on when asked to do so by software.

I was able to test it with various ROMs and programs. In general, it worked well if the software was using *official* calls (eg OSWRCH, and PLOT), but software which is programmed legitimately is hard to come by nowadays, usually only available from the Acornsoft stable. VIEW,

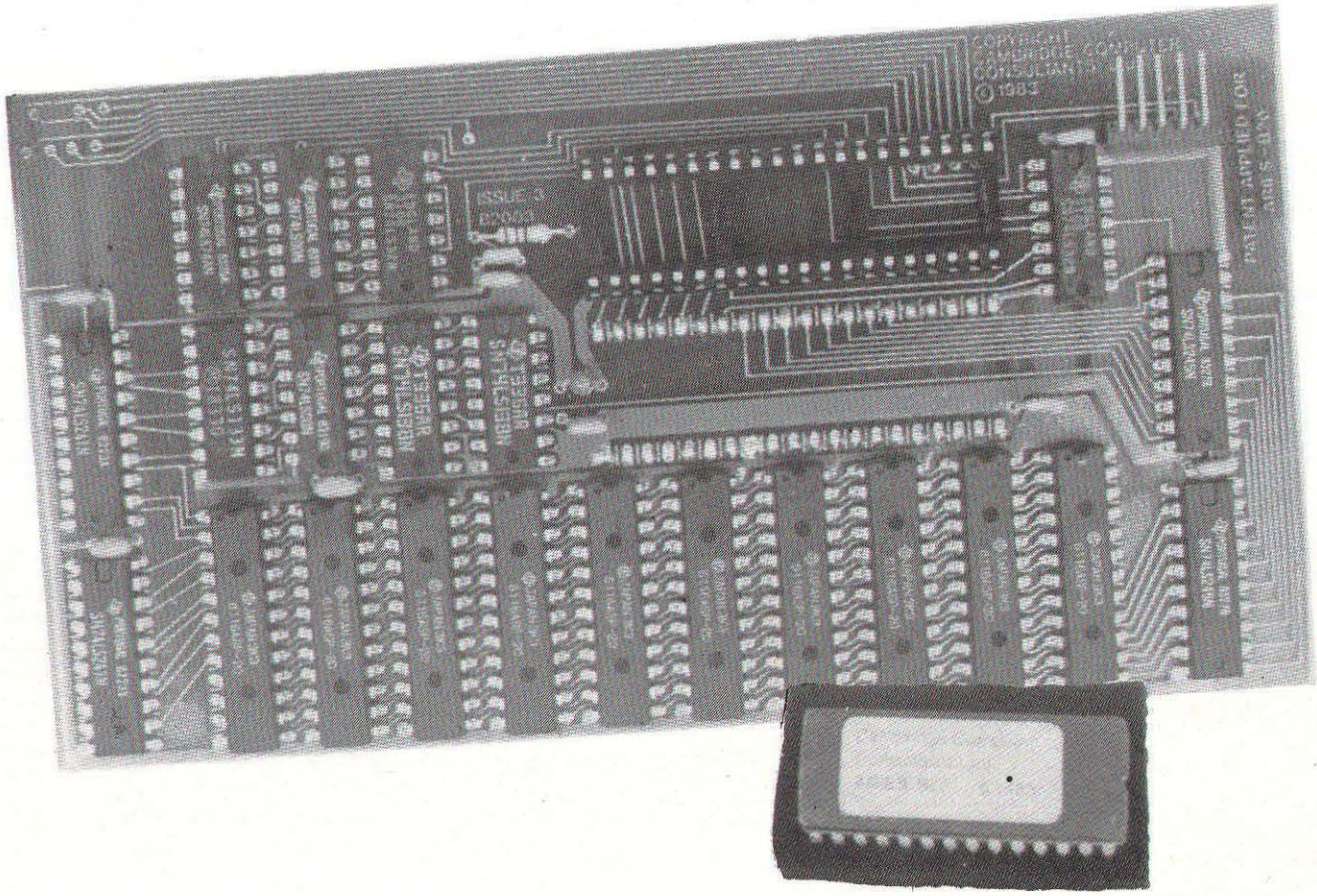


Extended memory map

FORTH, BCPL, LISP, will all gain significant amounts of memory, proportional to the usage of the screen mode that they require. VIEW normally provides 7K free when in 80 column mode, but now gives 28K free, which is exactly quadrupled, however, it is significant to note that if only MODE 7 is used by our software, then the memory increase is only 1K — which is hardly worth paying £100. When in it's OFF state, I found that there were no incompatibilities with any of the tested software, but in it's ON state, programs such as WORDWISE would display their menus, but not allow much further operation, except that nothing would be displayed on the screen so you would by 'typing blind!'. This is because they all make direct accesses to the screen memory, instead of using the operating system calls. Thus, they are POKING where there is now no more screen memory. It is a similar situation when using any of the recently available second processors.

CONCLUSION

I consider the ARIES B20 to be a very professional product. The manual is excellent, and the hardware is constructed to the same high standard that Acorn themselves have achieved. £99.95 does seem a bit pricey, especially when all the benefits of the second processors are available for around double the price, but if memory expansion is all that is required, then ARIES is significantly cheaper than the 6502 second processor and probably worth purchasing instead.



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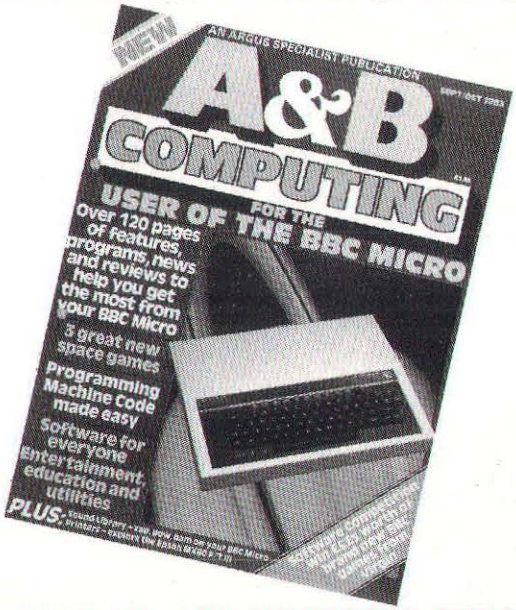

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Colourful CHRS

G W Gallagher

No one defining characters for use in Mode 2 can resist the lure of exploiting at least some of the 16 available colours. Here's how.

Designing characters with more than one foreground colour is an obvious step from User Defined Graphics. The method described here is for the 16-colour Mode 2, and requires calculations which might as well be done by the computer.

Starting from the 20 x 32 text screen, each of the text spaces can be split into 8 rows of 8 pixels. The screen memory contains one value to represent the colours of two adjacent pixels, which means that an 8 by 8 pixel characters is contained in the memory in 32 locations. To design such a character, there are four steps required:

1. Fix the colour number for each of the 64 pixels.
2. Convert each number to a binary number.
3. Merge two adjacent numbers together, by a method which seems to be peculiar to the BBC micro.
4. Transfer these 32 numbers to the screen in the correct order.

Fig. 1.

	1	2	3	4	5	6	7	8
1	1	1	1	2	2	2	3	3
2	3	1	1	1	2	2	2	3
3	3	3	1	1	1	2	2	2
4	3	3	3	1	1	1	2	2
5	2	3	3	3	1	1	1	2
6	2	2	3	3	3	1	1	1
7	2	2	2	3	3	3	1	1
8	1	2	2	2	3	3	3	1

Step 1

The example used for illustration is a simple diagonally striped design (Figure 1), using colours 1, 2 and 3, i.e. red, green and yellow.

Step 2

The binary numbers needed are

decimal 1	binary 100
2	0010
3	0011

Step 3

Merging the binary numbers is a process which results in one 8 bit number. The left hand dot of the pair provides the 1st, 3rd, 5th and 7th places, while the right hand member provides the 2nd, 4th, 6th and 8th places.

Thus 1 + 1 becomes

```
  0 0 0 1
+ 0 0 0 1
--------
00000011   = decimal 3
```

1 + 2

```
  0 0 0 1
+ 0 0 0 1
--------
00000110   = decimal 6
```

2 + 2

```
  0 0 1 0
+ 0 0 1 0
--------
00001100   = decimal 12
```

The table of values in Figure 2 is the result when all the calculations are completed.

Step 4

The values are stored in memory in the order in which they would be plotted, i.e. in this case 3,11,15,15,13,12,12,6,6, 3,3,etc.

	1	2	3	4
1	3	6	12	15
2	11	3	12	13
3	15	3	6	12
4	15	11	3	12
5	13	15	3	6
6	12	15	11	3
7	12	13	15	3
8	6	12	15	11

Figure 2.

THE PROGRAM

PROCbinary (1200 –) In this section, colour numbers stored in the array A$ are converted into strings containing the binary digits, and stored in the array B$.

PROCtotals (1370 –) The binary values representing two adjacent colours are merged together, using the appropriate powers of 2, to work out the decimal total, which is then stored in the array C%.

PROCarrange (1570 –) The values are rearranged in the correct order for plotting. This section can be shortened by using the MOD and DIV functions, but is did not seem to be necessary.

PROCscreen (1400 –) This section sets up the screen, showing the 8 by 8 square, and colours the sections of the square with the appropriate solid colour. There is a text area at the bottom of the screen, in which the question "Which colour?" is seen.

THE MAIN PROGRAM

The characters designed are plotted from memory using a simple machine code routine inside the basic program. The values of X and Y passed to the routine are the text coordinates of the position on the screen.

For the purposes of this demonstration, the position used is on the right of the screen, so that the character designed can be seen side by side with the grid on which it was designed.

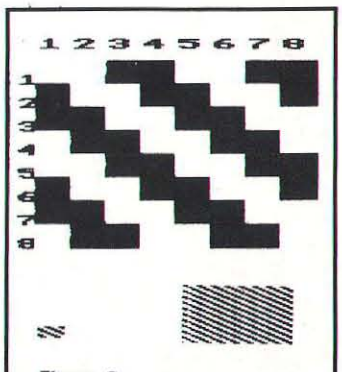

Figure 3

Line 10	sets the screen value at HIMEM
20	sets aside a section of memory to hold the machine code program.
30	sets the position for the beginning of the storage space to hold the values from the array D%.

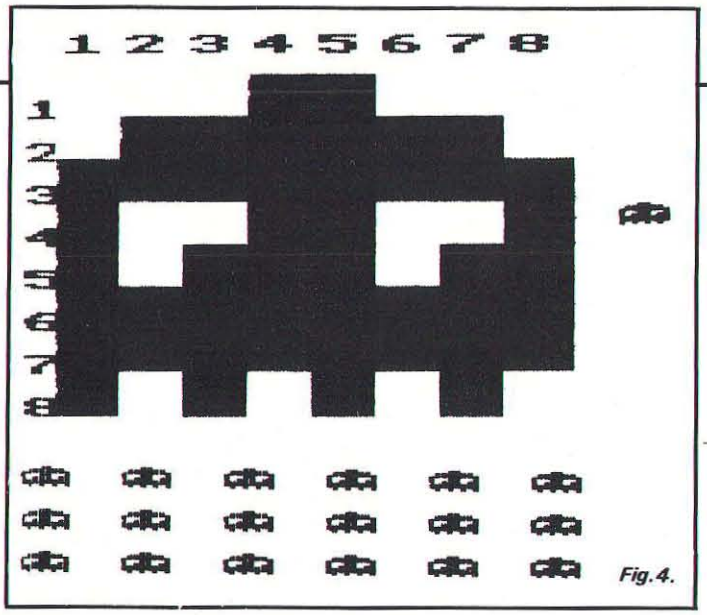

Fig.4.

50-100	work through the PROCs to take in the colour numbers and calculate the value for D%.
100-210	place the values in store.
130	Sets the position (16,10) at which the actual size image will be seen, at the side of the large original.
140	works out the screen location of the top left hand corner of the character position, allowing 640 points across the screen and 32 for each line down.
200-280	contain the machine code routine, calling the routine at line 280.

If the character is to be used in a larger program, it will be necessary to keep a record of the numbers to use, particularly if more than one character is to be used, perhaps joined together to form a larger shape. (Figures 3, 4)

PROCnumber (1700-1730) will list the values from array D% on the screen.

PROGRAM LISTING

```
  5 MODE2
 10SCREEN=HIMEM
 20 DIM P% 250
 30BASE=&400
 40DIM A%(64),B$(64),C%(32),D%(32)
 50PROCscreen
 60FOR I=1 TO 64:PROCbinary:NEXT
 70FOR I=1 TO 63 STEP 2
 80J=INT((I+1)/2)
 90PROCtotals
100NEXT:PROCarrange
110FORI=1 TO 32
120?(BASE+I)=D%(I):NEXTI
130 X=16:Y=10
140LOC=SCREEN+Y*640+X*32
200[
205OPT 3
210.START
215 LDX#32
220.LOOP
225 LDA BASE,X
230DEX
240STA LOC,X
250 BNE LOOP
260RTS
270]
280 CALL START
730CLS:PRINTTAB(0,17)"Do you wish to amend this?(Y/N)":
INPUT N$
740 IF N$="Y" THEN 50
750IF N$="N" THEN 760 ELSE 730
760CLS:PRINTTAB(0,17)"Do you wish to record the numbers
      used(Y/N)"
770INPUT N$:IF N$="Y"THEN 380 ELSE 990
380MODE7:PROCnumbers
990 END
1000DEFPROCprint
1030 LOC=SCREEN+Y*640 + X*32
1050CALL START
1080ENDPROC
1200DEFPROCbinary
1205IF A%(I)=0 THEN B$(I)="0000"
1210IF A%(I)=1 THEN B$(I)="0001"
1220IF A%(I)=2 THEN B$(I)="0010"
1230IF A%(I)=3 THEN B$(I)="0011"
1240IF A%(I)=4 THEN B$(I)="0100"
1250IF A%(I)=5 THEN B$(I)="0101"
1260IF A%(I)=6 THEN B$(I)="0110"
1270IF A%(I)=7 THEN B$(I)="0111"
1280IF A%(I)=8 THEN B$(I)="1000"
1290IF A%(I)=9 THEN B$(I)="1001"
1300IF A%(I)=10 THEN B$(I)="1010"
1310IF A%(I)=11 THEN B$(I)="1011"
1320IF A%(I)=12 THEN B$(I)="1100"
1330IF A%(I)=13 THEN B$(I)="1101"
1340IF A%(I)=14 THEN B$(I)="1110"
1350IF A%(I)=15 THEN B$(I)="1111"
1360ENDPROC
1370DEFPROCtotals
1380 C%(J)=VAL(LEFT$(B$(I),1))*2^7+VAL(MID$(B$(I),2,1))*
2^5+VAL(MID$(B$(I),3,1))*2^3+VAL(RIGHT$(B$(I),1))*2^1
1390C%(J)=C%(J)+VAL(LEFT$(B$(I+1),1))*2^6+VAL(MID$(B$(I+
1),2,1))*2^4+VAL(MID$(B$(I+1),3,1))*2^2+VAL(RIGHT$(B$(I+1
),1))
1400ENDPROC
1410DEFPROCscreen
1420VDU28,0,31,19,24:GCOL0,7
1440 FOR I=0 TO 8:MOVE 80,900-I*64:DRAW720,900-I*64:NEXT

1450 FOR I=0 TO 8:MOVE 80+I*80,900:DRAW80+I*80,388:NEXT
1460VDU5:FOR I=1 TO 8:MOVE 84+(I-1)*80,960:PRINT;I:NEXT

1470FOR I=1 TO 8:MOVE 32,860-(I-1)*64:PRINT;I:NEXT
1480VDU4 :FOR I=1 TO 64
1485 J=((I-1) MOD 8)+1:K=(I-1) DIV 8
1490PRINTTAB(0,17);"Which colour(0-15)?":INPUT A%(I)
1500GCOL0,A%(I):MOVE80+(J-1)*80,900-K*64:MOVE80+(J)*80,9
00-K*64:PLOT85,80+(J-1)*80,900-(K+1)*64:PLOT85,80+(J)*80,
900-(K+1)*64
1510CLS:NEXT I
1560ENDPROC
1570DEFPROCarrange
1580D%(1)=C%(1):D%(2)=C%(5):D%(3)=C%(9):D%(4)=C%(13):D%(
5)=C%(17):D%(6)=C%(21):D%(7)=C%(25):D%(8)=C%(29)
1590D%(9)=C%(2):D%(10)=C%(6):D%(11)=C%(10):D%(12)=C%(14)
:D%(13)=C%(18):D%(14)=C%(22):D%(15)=C%(26):D%(16)=C%(30)
1600D%(17)=C%(3):D%(18)=C%(7):D%(19)=C%(11):D%(20)=C%(15
):D%(21)=C%(19):D%(22)=C%(23):D%(23)=C%(27):D%(24)=C%(31)

1610D%(25)=C%(4):D%(26)=C%(8):D%(27)=C%(12):D%(28)=C%(16
):D%(29)=C%(20):D%(30)=C%(24):D%(31)=C%(28):D%(32)=C%(32)

1630 ENDPROC
1700 DEFPROCnumbers
1710 VDU26:PRINT"The numbers, in the correct order are:"
1720 FOR I=1 TO 32:PRINTD%(I);:NEXT
1730 ENDPROC
```

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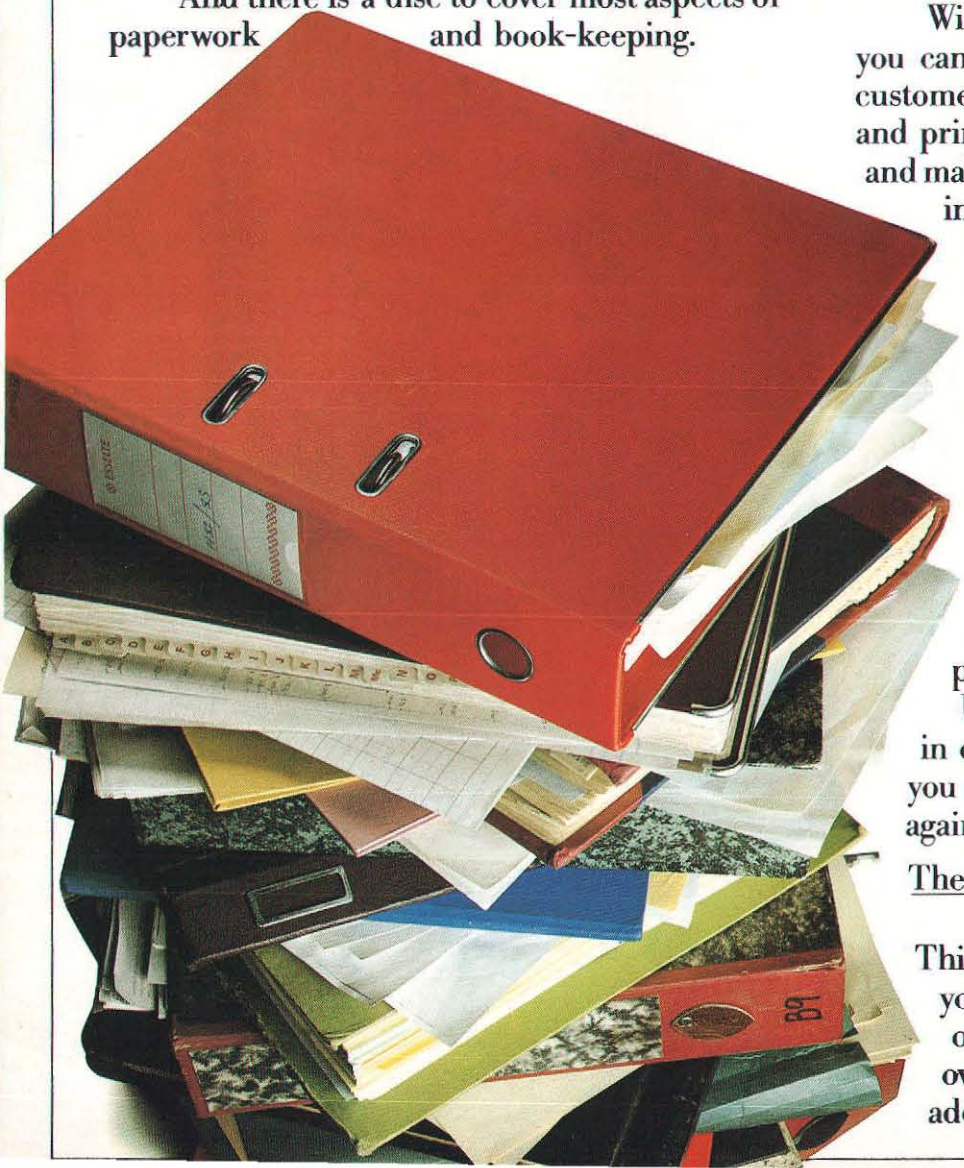

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Walk Before You Run

Richard Ives

Join Richard Ives and A&B as we embark on our new series for beginners.

Welcome to the new Beginners' BASIC Series in 'A & B Computing'. I shall be writing this piece in each issue of the magazine from now on, so I hope that those of you who have just acquired a BBC or an Electron will join me for an exploration of these machines, starting from the very beginning.

If you haven't got a computer, you can still learn things from here, but start saving up for a machine; it's much more fun if you can follow these pieces and try out the exercises on your machine! The information given in this series (unless, at a particular point, I say otherwise) applies equally to the BBC machines and to the Electron. To get the most out of this series, sit down with your computer and type these illustrations and examples directly into your computer, just as they are written.

PRINTING

This month, I'm going to concentrate on how to get text to appear on the screen.

Because BASIC is an old-fashioned language, devised when computers were connected up to teletype printers, and you didn't have a screen to look at, the command to get something to appear on the screen is PRINT.

If you want to print a message you put your message in double quotation marks (or speech marks) after the word PRINT, like this:

PRINT "Hello Human" (and press RETURN)

Notice that we are not, at the moment, using any line numbers before the PRINT statement. This will mean that when we press the RETURN key, the computer will carry out our PRINT instruction straight away. We refer to this as working in command mode.

Anything that appears after a PRINT statement is called the PRINT list. In this example, there is only one element in the PRINT list: Hello Human. This is called a literal string, because the PRINT statement literally PRINTs out the string of characters contained inside the quotation marks. Note that spaces inside a literal string will also be printed, so:

PRINT " HELLO HUMAN " (RETURN)

will appear with a space between each letter as well as one at the beginning and the end.
Now try this:

PRINT 5+7 (and press RETURN).

The sum of five and seven (that's twelve for those of you who need your computer to learn to add up!) is PRINTed. The computer can do arithmetic inside the PRINT statement. So, try writing:

PRINT "5+7 = " 5+7

Here we have a PRINT list with two elements (or items, if you like): a literal string, the 5+7 = enclosed in speech marks, and the expression, 5+7, the answer to which will be worked out and then PRINTed.

In BASIC, + and − are represented by the same symbols as in ordinary arithmetic, but to multiply we use: *. Divide is: /. You can use brackets in the way that you would in ordinary arithmetic, for example: 4+5*2 will be worked out as 14 (two fives are ten, four plus ten is fourteen) but (4+5)*2 will come out as 18 (four plus five is nine, two nines are 18). You can use decimal numbers, as well as whole ones, using the full stop which doubles as a decimal point, and raise numbers to powers with the ^ key.

Note for BBC users: in MODE 7 you can get a divide character, but it won't divide things! You can also PRINT certain fractions, but the Beeb won't deal with these either.

EXERCISE: Try some arithmetic. . .you can use the computer like a calculator. Use PRINT to do some complicated calculations and impress your friends.

VARIABLES

Very often we don't just want to PRINT a literal string, we want to PRINT the contents of a variable. For example, try typing in this:

```
10 LET NAME$ = "FRED"
20 PRINT "Hello there"
30 PRINT NAME$
```

Notice that this time we are using line numbers because we need to store these instructions in the computer's memory. The instructions we type in will not be 'executed' (carried out) until we type the BASIC word RUN (and press RETURN). Then they will all be carried out one after the other.

We have stored in the variable, which I have chosen to call NAME$, the name "FRED", and we have PRINTed it out after Hello there. Notice that NAME$ in line 30 is not enclosed in quotes (why not? − because we don't want the string of characters "NAME$" to appear, we want to print the string of characters (in this case, "FRED", which is stored in the variable NAME$). Try replacing line 10 with other values for NAME$ − e.g.

```
10 LET NAME$ = "Nellie".
```

And you don't have to call the variable NAME$ − it could be almost anything, but it must end in a dollar sign (more of this later in the series).

But suppose you want the output for our 3-line program to appear all on the same line? Try:

```
20 PRINT "Hello there"
   NAME$
```

This does the trick, but try:

```
20 PRINT "Hello there" ;
NAME$
```

A semi-colon makes the computer PRINT the next thing in the PRINT list immediately after the previous element. But we require a space between the literal string and the variable, so that it appears as: "Hello there Nellie" rather than "Hello there Nellie".

Learning: a joint effort at Summer school.

WE can do this by inserting a space inside the speech marks. Remember, the computer PRINTs out exactly what is contained between the speech marks, so it will PRINT the space as well. (After all, it has already PRINTed the space between Hello and there!) So try:

```
20 PRINT "Hello there " ;
NAME$
```

A comma has a different effect:

```
20 PRINT "Hello there" ,
NAME$
```

The screen is divided into PRINT fields which are 10 characters wide; a comma between elements in the PRINT list forces PRINTing to start at the next field (fields start at the first, eleventh, twenty-first, . . . character position. Modes 2 & 5 give us a screen with 20 characters across, Modes 1,4,6 (and on BBC machines, mode 7) a screen 40 characters wide, and Modes 0 & 3 one of 80 characters). These different screen sizes hold pitfalls for the Beginning Programmer, since PRINTed text that looks good in one screen mode will be split up differently on the smaller screen of another. A single quote in a PRINT list causes a new line to be started:

```
20 PRINT "Hello there" '
NAME$
```

This line of BASIC causes the contents of the variable NAME$ to be PRINTed at the beginning of a new line. PRINT on its own PRINTs a blank line. If a PRINT list does not end with a semicolon, then the next PRINT statement will start on a new line.

PRINTING ON A PARTICULAR PART OF THE SCREEN

So far, we have learnt to PRINT things on the same line or the next available one. We may wish to place our print string more precisely on the screen. To do this, we can use the TAB function. Try:

```
PRINT TAB(5)"Hi"
```

You will notice that Hi appears starting in column five across the screen. The printed result from the next example may surprise you; see if you can work out what's happened before you read my explanation! Type:

```
MODE 6
PRINT TAB(15)"Hi" TAB(10)
"Hi again"
```

Obviously (when you think about it) once the computer has PRINTed at the 15th column position, it has gone past the 10th, so it will start a new line to find a 10th position that it hasn't been past. TAB can also be used to PRINT at a particular column on a particular line. We have to put two numbers in the brackets after the word TAB, the first meaning the column, the second referring to the line. The origin, from which we count lines and columns, is the top left hand corner of the screen.

EXERCISES: (i) Write a short program which PRINTS out several lines of information in mode 6 about, say, a game. Then convert it to run in Mode 2 while still producing readable information.
(ii) Write a program to PRINT a series of statements on the screen from the bottom line upwards!
(iii) If you know how to generate random numbers (or want to learn and practice using them) then write a program to PRINT a welcoming message at a number of random positions on the screen.

USING THE PRINTER

For the benefit of BBC owners, if we want something to be printed out on the printer (instead of only on the screen) we first have to make sure that the printer is connected to the computer (and, if it is connected serially, the computer is set up to send at the right speed), and, of course, switched on. We then have to inform the computer that we want it to send to the printer what appears on the screen. Confusingly, this is sometimes referred to as 'turning the printer on'. To do this, we insert at the appropriate point in our program: VDU 2. After this, all output is routed to the printer as well as to the screen. To stop sending output to the printer we use VDU 3. We can also turn on the printer by holding down the control key and simultaneously pressing 'B'. Since it will not have escaped your notice that 'B' is the second letter of the alphabet, I'll leave it to you to work out how to turn off the printer using the control key.

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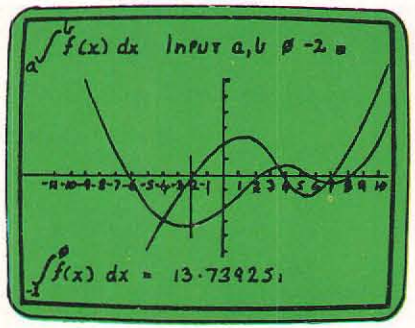

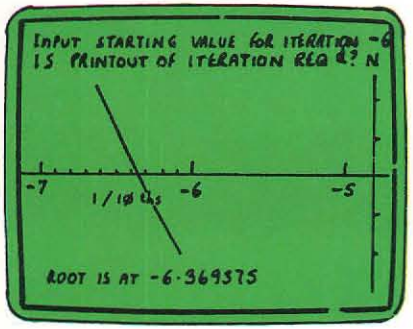

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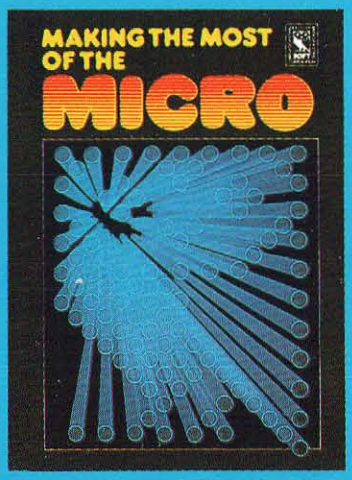
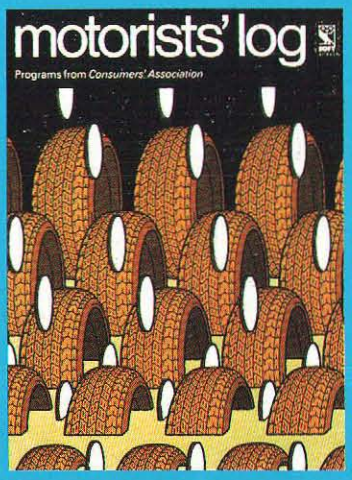
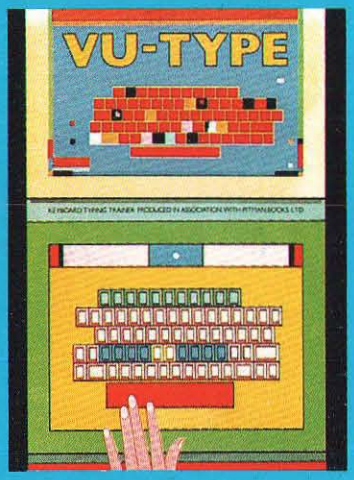
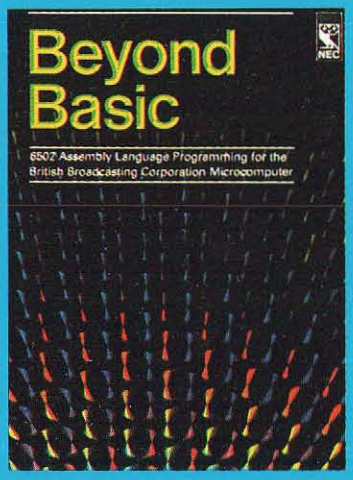
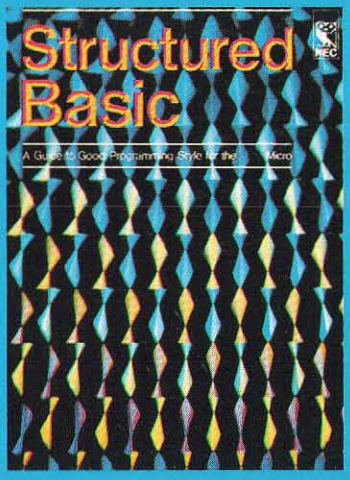
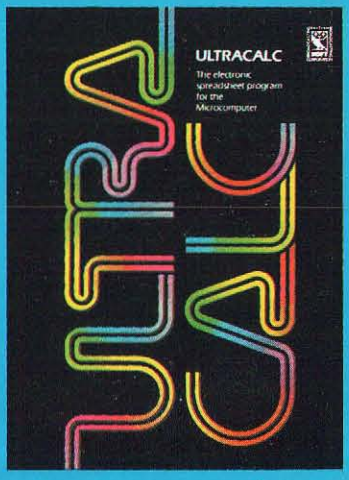












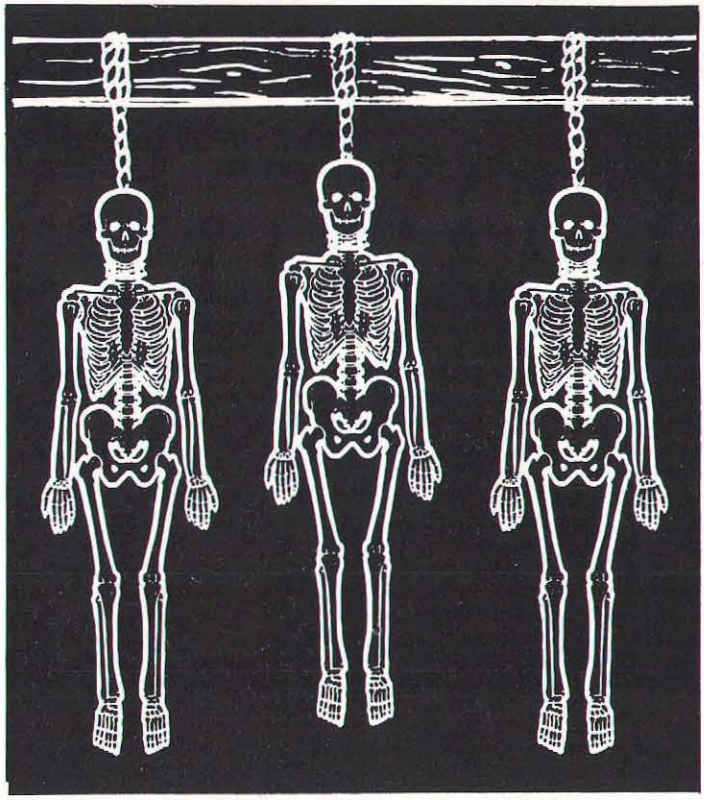
All packs are designed for the British Broadcasting Corporation Model B Microcomputer, operating system 1.0 onwards. Motorists' Log, VU Type and most of Beyond Basic will also run on 0.1. Prices include VAT. *Ultracalc is supplied on a ROM chip which should preferably be installed by a dealer.

FROM BOOKSELLERS AND MICRO DEALERS

Microhangman

Alan Rowley

This traditional game is the basis of a comprehensive vocabulary teaching aid.



I suppose the first question to be answered is "Why write another hangman?", after all the A&B Computing list already shows five or six of them. Well, we wanted to meet some very specific requirements and to have a very flexible program which would be useable right through Infant's and Primary school, the main needs were:

(1) We should be able to set up our own vocabularies consisting not only of single words but of short phrases.

(2) Upper and lower case letters in any combination should be allowed in the input vocabulary, although they should be equivalent as far as the pupils' response is concerned.

The idea here was to be able to make the answers look as realistic as possible so that the game could function as a reading aid as well as a simple word recognition test.

(3) We wanted, if necessary, to be able to offer clues to the pupils in a variety of forms. For example we might want to give them the vowels, consonants or all the first letters of the words. This is not just a matter of being able to alter the degree of difficulty of the game but also to provide a facility to angle it towards the weaknesses of individuals. We also wanted to be able to prompt with a description of the general classification of the answers, e.g. to say that they were all the names of local streets.

(4) The number of wrong guesses allowed at each word had to be variable so that we could make the game easier to harder.

(5) Some kind of attractively (to children) gruesome graphics representation of the hanging would increase the appeal of the game, but since we wanted the vocabularies to be as large as possible this would need to use MODE 7 to save memory. A little experiment showed that we could get something acceptable and indeed some of the other facilities of MODE 7, like the ability to 'conceal' and 'reveal' and the ability to mix double and single height letters, also proved very useful.

(6) There would have to be two programs in the package, Listing 1, which is the program used by the teacher to set up and modify vocabularies and, Listing 2, the actual games program used by the pupils. The teacher's program creates a tape file with the words and the clue information, which is read in by the pupil's program. This requirement for two programs was dictated by memory considerations. It went without saying that the pupil's program had to be very friendly and well input crash protected but we also wanted the teacher's routine to be easily used by non-computer people.

The only other points to be decided upon were the two interrelated terms, the maximum length of entry and the maximum number of wrong letter guesses which would be allowed before a 'hanging'. The maximum entry length was set at twenty letters as being adequate and fitting the screen format we had in mind. This permits up to 350 entries, but the maximum length of an entry can be traded off to allow a larger vocabulary. The shortest maximum length is 4 letters, which allows a vocabulary of up to 1750 words. The maximum length and the derived maximum vocabularly size are the only parameters which cannot be altered once set up, since they are used to set array sizes, so some thought is required in deciding on them. The best rule to work to is to set the maximum entry length at a generously high figure unless there is a specific need to have a large number of entries in the vocabulary. The maximum number of wrong guesses was set at 15.

THE VOCABULARY SET-UP PROGRAM

This program is menu driven. An initial menu selects for the two modes of use of the program, setting up a new vocabulary or editing an existing one. In the latter case the tape file loading sequence is entered and then the main menu is displayed. If you are starting a new vocabulary you are first asked for the maximum entry length and the corresponding vocabulary you are first asked for the maximum entry length and the corresponding vocabulary size is displayed for your approval or rejection. Rejection takes you back for a re-entry of the maximum length, acceptance lets you go on to set up the clue details and the number of wrong letter guesses leading to a 'hanging', although any of these details can be altered late. You are now ready to begin entering words or phrases.

Only letters and spaces are accepted and each entry must be at least three characters long, and of course, no longer than the maximum entry length. An entry will be presented to the pupils *exactly* as typed at this stage. The only other point to note is that only *single* spaces between words are allowed. This constraint, not a serious one, was introduced to make the coding of the section of the game program which deals with the clue condition where the first letters of words are supplied, much simpler than it would otherwise have needed to be. The word entry routine is left by entering 'ZZZ' instead of a word, and the main menu is displayed.

Most of the main entries are self explanatory. Essentially you can add to the end of the vocabulary, view the vocabulary and edit or delete any entry and similarly inspect and alter the details of the clue condition or description. For editing purposes an entry can be found most quickly by its number, which is itself found from the display option, but if you wish you can find an entry by searching on the basis of a search term consisting of a sequence of letters and spaces.

The vocabulary must be saved to tape before ending the program. A warning is given if you are in danger of forgetting to do this, so the only source of real disaster is clumsy fingers on the BREAK key!

THE GAME PROGRAM

This begins by prompting for the tape to be loaded and then, after loading the tape file, returns to the header page and prompts for the space bar. There is a 'hidden' facility available at this point to enable the teacher to alter the clues given to the pupil and the number of wrong guesses allowed. Alterations made here will only be temporary, of course, permanent changes will need the file tape to be remade after editing the details with the set-up program.

The game starts with a demonstration of the graphics and a brief description of rules. Three attempts are allowed at each word before the answer is supplied. The game ends either when the player decides or when all the words have been used up. If a replay is selected the words are shuffled so that they appear in a different order.

CONVERSION

The programs were written on a machine with operating system 1.2 and BASIC 2 but care has been taken to make them run under BASIC 1. This mainly involved writing round the INSTR bug. There is no reason why an expanded model A should not be used but this has not actually been tried.

As written the package will run on a disc without relocation and, if required, it could support a rather larger vocabulary on a tape machine, but we were anxious to maintain tape/disc compatability. To get more words increase the 7000 in line 68 of the set-up program.

HOW IT RUNS

The Set-up Program
The main program runs down to line 46, the remainder consists of procedures. The main control structure is the REPEAT...UNTIL loop between lines 24 and 43 which controls the menu section.
The Main Program
The main program again runs to line 46 and the main control struture is all within the REPEAT...UNTIL loop between lines 15 and 44. The game is played within the FOR...NEXT loop between lines 25 and 41 which keeps count of the number of words used with the variable TN%.

I have generally tried to avoid GOTO, but not where this would involve elaborate expedients. There is nonetheless no spaghetti!

PROGRAM DESCRIPTIONS

set. The procedure also checks for multiple spaces. If any are found the flag sef% is set. Line 62 can be much simplified in BASIC 2 by taking out all the conditional part and leaving the FOR.....NEXT loop. The construct shown is necessary to avoid the use of INSTR with the second argument longer than the first, which will cause a crash in BASIC 1.

PROCnewvoc The main control routine for setting up the new vocabulary. The main array, WORD$, which holds the vocabulary is dimensioned and then a call to PROCinit fills it completely with spaces. This padding technique is not only a good idea to allow for the odd garbage collecting habits of the BBC, but is also useful in that it gives you an instant check on memory availability when the program is being developed. The padding of spaces fills the array to maximum capacity immediately, entered words merely replace the spaces. It would be very time consuming, and potentially embarassing, to find out the memory availability for the array after entering several hundred words and hitting an out of memory error! The remainder of PROCnewvoc calls other procedures which are used to take and check the input of the vocabulary description and the clue details. A final call to PROCextvoc starts the word entry sequence.

PROCinclas Inputs the description of the vocabulary which is supplied to the pupil. This can be left out by a null entry i.e. pressing RETURN.

PROCinclue Inputs the clue condition. This is stored as the value of the flag variable PC%.

PROCeditdet Display the current details of the clue condition etc. and allow alteration if required.

PROCinwd Takes input of the words. Initially the input is stored in inwd$ for checking for valid characters and length. This prevents garbage collection problems arising with the main array WORD$ as a result of entering over long words. The temporary store inwd$ has been padded to a generous 30 characters in the initialisation sequence and so should be safe from relocation. Only after the input has been validated is it read into an element of WORD$.

PROCextvoc Used to add words to the end of the vocabulary. Ends when the vocabulary is full or when the entry is ZZZ or zzz.

CONTINUED OVER

THE SET-UP PROGRAM

Line Description	Initialisation and display of the header page. String variables are paddded out with a generous ration of spaces to avoid garbage collection problems causing an out of memory error later. The *FX call in line 8 disables the ESCAPE key.
Lines 18 to 23	Selection of entry mode, start a new vocabulary or edit.
Lines 24 to 43	Main menu display and selection routine.
Lines 44 to 46	re-runs the program or ends it with the machine restored to normal.

Procedures

PROCselectfrom A utility routine which waits for a key in ALLOWED$. The *FX calls set the keyboard in capitals and flush the buffer.

PROCcheckinput Check WORD$ for validity. If a character other than letters or a space is found the flag INEF% is

PROCdisp Displays the vocabulary in 'page' mode. The entries are numbered for ease of identification.
PROCinit This routine pads out the array WORD$, with spaces, to its maximum capacity.
PROCeditvoc The control routine for editing the vocabulary. An entry can be selected by number or by means of a search term. In the latter case the search routine, PROCsch, is called.
PROCdel Deletes the entry whose number is passed as the parameter DLNO%. The deletion is simply accomplsihed by 'rolling back' the array to overwrite the entry we want to lose.
PROCsch Search the vocabulary for the search term entered as S$. INPUTLINE is used to take the input so that leading and trailing spaces are preserved. Line 201 is only required in BASIC 1, again to avoid the bug in INSTR.
PROChit The procedure called by PROCsch when it finds a match for the search term. The choice is given to edit the entry found, to exit to the main menu or to continue searching with the same search term if you have not found the entry you want.
PROCsave Writes the vocabulary to tape as a named data file.
PROCload Loads a vocabulary from tape and dimensions and pads the array WORD$. A specific vocabulary can be loaded by entering its name or pressing RETURN will load the first file on the tape.
PROCofff Switches the cursor off.
PROCon Switches the cursor on.
PROCwarn The routine which is always called when you try to end or re-run the program. Gives you a chance to recover if you have forgotten to save the data to tape.
PROCerr The error trapping, as first set at line 6, RUN's the program after a report. Once a vocabulary has been set up this is not suitable as it would destroy all the data. PROCerr sends execution back to the main menu after an error report, hence preserving the data. The only errors arising should be tape faults.

MAIN GAME PROGRAM

Line Description	Initialisation and display of the header page by calling PROCst.
Lines 12 to 14	Prompts for loading of the data from tape if necessary, i.e. if no data has been loaded and NOW% = 0. This allows the program to be re-run without the data having to be reloaded each time.
Lines 15 to 16	Waits for the space bar or the '?' key. In the former case starts the game or if '?' is pressed calls PROCchg which allows the details to be altered.
Lines 17 to 24	Demonstrates the 'hanging' graphic, displays the rules and then waits for the space bar before starting the game. The clue condition is displayed if appropriate.
Lines 25 to 28	Initialises the game and calculates the number of letters to be guessed, using FNwdln, taking into account the clue condition, i.e. whether the vowels etc. have already been done, and displays the 'hanging' progressed to a point that leaves the right number of wrong guesses to completion. PT$, which is also set up by FNwdln, is displayed and represents by asterisks. Double height characters are used for this.
Lines 29 to 32	Determines and displays the letters already supplied as clues.
Lines 33 to 35	calls for input with a flashing message. When a letter key is pressed the flashing stops and the letter entered is displayed. The use of PROCselectform ensures that all but letter keys are ignored.
Lines 36 to 38	Checks to see if the letter entered has already been tried. If it has a message it is displayed as a 'reveal'. Otherwise the letter is added to the used letter list in UL$ and then a check is made to see if the letter is in the word by calling PROCchk. If the letter has been used already a re-input is requested.
Lines 39 to 41	Checks to see if all the letters have been guessed or if the number of guesses has been exhausted, If all the guesses have been used, NW% = 15, then PROCdead is called. Control is then passed, as appropriate. Another word is presented if three abortive attempts have been made at the present one, otherwise further attempts are allowed. If the word has been completed then PROCwin is called. If all the words have been worked through or the player has chosen to end the game TN% will be such as terminate the FOR. . . .NEXT loop at line 41.
Lines 42 to 44	Displays the end of game score and prompts for re-play or end.
Lines 45 to 46	Ends program with machine restored.

Procedures and Functions

PROCdel A software delay of length determined by the value of x%.
PROCconv Takes the player's key press in A$ and adds to it the corresponding high or low case letter, as appropriate, before A$ is searched for in the word by PROCchk. Makes high and low case fully equivalent in words or as input.
PROCchk Carries out a check to see if the input letter is in the word. If the first letters of the word are being supplied the result is adjusted by calling PROCflchk. Correctly guessed letters are added to the displayed word.
PROCflchk Deals with the situation which pertains when the first letter of the word is supplied as a clue. It is necessary to check whether there are any occurences of a letter, as found by PROCchk, which are the first letters of words and to adjust the return given by PROCchk accordingly.
PROCwin Sequence on completion of a word.
PROCdead Sequence on failure to guess the word successfully
PROChand The routine which produces the hangman graphics.
PROCvert Utility used in the graphics routines to write a vertical column of CHR$(c%) starting at TAB(1%,y%) and of length n%.
PROCman Produces graphics which draw the man.
PROCshuf Shuffles the array containing the words so that the order in which they are presented is varied on each run.
FNwdln Calculates the number of letters to be guessed from the length of the entry and with reference to what is supplied as a clue, if applicable.
PROCfud Called by FNwdln to build the string, PT$ which is what is shown to the pupil as a prompt.
PROCst Display a header page.
PROCscr Sets up the basic screen with the necessary messaged and teletext control characters. The message printed in line 175 is concealed until required.
PROCclue Displays the clue condition.
PROCchg This is the hidden facility which lets the teacher change the clue condition and the number of guesses allowed.

All other procedures are as discussed in the description of the set-up program.

PROGRAM LISTING 1

```
    60ON ERROR CLS:CLOSE#0:PRINT"ERROR"'''':REPORT:Y$=INK
EY$(1000):RUN
    7REP$="PLEASE TRY AGAIN"+CHR$(10)
    8MODE 7:NOW%=0:PROCcoff:*FX200,1
    9CLAS$=STRING$(40," "):S$=STRING$(25," "):wa$="":in
wd$=STRING$(30," ")
   10FOR I=5TO6
   11PRINTTAB(11,I);CHR$(141);CHR$(157);CHR$(129);"HANG
MAN  ";CHR$(156)
   12NEXT I
   13PRINTTAB(2,13);CHR$(131);CHR$(136);"*Copyright****
*Alan G. Rowley*"
   14PRINTTAB(8,16);CHR$(131);CHR$(136);"(C)JULY 1983"
   15PRINTTAB(9,23);CHR$(157);CHR$(129);"SET-UP PROGRAM
  ";CHR$(156)
   16*FX15,1
   17A$=INKEY$(500)
   18CLS
   19PRINT"Do you wish to:-"
   20PRINT'''TAB(2);"A. LOAD A VOCABULARY FROM TAPE"
   21PRINT''TAB(2);"B. CREATE A NEW VOCABULARY"
   22PROCselectfrom("AB")
   23W$=A$:IF W$="A" PROCload ELSE PROCnewvoc
   24REPEAT CLS
   25FOR I=0 TO 1
   26PRINT TAB(15,I);CHR$(141);"*MENU*":NEXT I
   27PRINTTAB(16);CHR$(151);",,,,"'''
   28PRINTTAB(5);"1. DISPLAY/EDIT DETAILS."'
   29PRINTTAB(5);"2. DISPLAY VOCABULARY."'
   30PRINTTAB(5);"3. EDIT VOCABULARY."'
   31PRINTTAB(5);"4. ADD TO VOCABULARY."'
   32PRINTTAB(5);"5. SAVE VOCABULARY TO TAPE."'
   33PRINTTAB(5);"6. RE-RUN PROGRAM."'
   34PRINTTAB(5);"7. END."
   35PRINT''''"No. of entries left ";MAXWDS%-NOW%
   36PROCselectfrom("1234567"):Q$=A$
   37IF Q$="1" PROCeditdet
   38IF Q$="2" AND NOW%>0 PROCdisp
   39IF Q$="3" AND NOW%>0 PROCeditvoc
   40IF Q$="4" AND NOW%<MAXWDS% THEN PROCextvoc
   41IF Q$="5" AND NOW%>0 PROCsave
   42IFQ$="6"ORQ$="7"PROCwarn
   43UNTIL(Q$="6" OR Q$="7")ANDwa$="CONTINUE"
   44IF Q$="6" RUN
   45MODE7:*FX200,0
   46END
   47DEFPROCselectfrom(ALLOWED$)
   48*FX202,32
   49*FX15,1
   50PROCcoff
   51REPEAT A$=GET$
   52UNTIL INSTR(ALLOWED$,A$)
   53PROCcon
   54ENDPROC
   55DEFPROCcheckinput(WORD$)
   56LOCAL I,CHAR$
   57INEF%=0:sef%=0
   58FOR I=1 TO LEN(WORD$)
   59CHAR$=MID$(WORD$,I,1)
   60IF INSTR("ABCDEFGHIJKLMNOPQRSTUVWXYZ abcdefghijklm
nopqrstuvwxyz",CHAR$)=0 INEF%=1:I=LEN(WORD$)
   61NEXT I
   62IF LEN(WORD$)<3 ENDPROC ELSE FORI=2TOLEN(WORD$):IF
 INSTR(WORD$,STRING$(I," "")):sef%=1:I=LEN(WORD$):NEXT E
LSE NEXT
   63ENDPROC
   64DEFPROCnewvoc
   65REPEAT CLS
   66PRINTTAB(0,5);"What is the maximum length of entry
   67INPUT"you are going to use ? 4 to 20 lett. "MAXLEN
%
   68MAXWDS%=INT(7000/MAXLEN%)
   69PRINT'"   This vocabulary will have ";MAXWDS%'"
 entries. Is this O.K.? (Y/N)"
   70PROCselectfrom("YN")
   71UNTIL MAXLEN%<21ANDMAXLEN%>3ANDA$="Y"
   72PRINT''"Setting up vocabulary with ";MAXWDS%" entr
ies."'"       Please wait a moment."
   73DIM WORD$(MAXWDS%)
   74PROCinit
   75PROCinclas
   76PROCinmaxw
   77PROCinclue
   78PROCerr:PROCeditdet
   79PROCextvoc
   80ENDPROC
   81DEFPROCinclas
   82REPEAT CLS
   83PRINTTAB(0,5);"Vocabulary description-30 char.max."
   84PRINT"Optional press 'RETURN' to leave out."'
   85IF LEFT$(CLAS$,1)<>" "PRINT'"Currently:-"'" "CLAS
$
   86PRINTTAB(30);"*"
   87INPUT">"CLAS$
   88IFLEN(CLAS$)>30 THEN CLAS$=STRING$(40," ")
   89UNTIL LEN(CLAS$)<31
   90ENDPROC
   91DEFPROCinmaxw
   92REPEAT CLS
   93PRINTTAB(0,10);"How many wrong guesses per word wi
ll"'
   94INPUT"produce a hanging 2 to 15 ? "FAILMAX%
   95UNTIL FAILMAX%>1 AND FAILMAX%<16
   96ENDPROC
   97DEFPROCinclue
   98CLS
   99PRINT"Which clue condition ?"
  100PRINTTAB(10,8);"1. No Clue."
  101PRINT'TAB(10);"2. First Letters of Words."
  102PRINT'TAB(10);"3. Vowels."
  103PRINT'TAB(10);"4. Consonants."
  104PROCselectfrom("1234")
  105PC%=VAL(A$)
  106ENDPROC
  107DEFPROCeditdet
  108REPEAT CLS
  109PRINTTAB(11);"CURRENT DETAILS"'
  110PRINTTAB(11);"_______________"
  111PRINT"Description reads:-"'
  112IF CLAS$="" CLAS$="Not invoked."
  113PRINT CLAS$
  114PRINT'"No. of wrong guesses giving hanging ";FAILM
AX%
  115PRINT'"Clue condition-";
  116IF PC%=1 PRINT"No clue."
  117IF PC%=2 PRINT"1st. Letters."
  118IF PC%=3 PRINT"Vowels."
  119IF PC%=4 PRINT"Consonants."
  120PRINTTAB(0,14);"A. Edit Description"
  121PRINT"B. Edit no. of wrong guesses"
  122PRINT"C. Change Clue Condition"
  123PRINT"D. Escape."
  124PROCselectfrom("ABCD"):R$=A$
  125IF R$="A" PROCinclas
  126IF R$="B" PROCinmaxw
  127IF R$="C" PROCinclue
  128UNTIL R$="D"
  129ENDPROC
  130DEFPROCinwd
  131REPEAT INPUT">"inwd$
  132IF LEN(inwd$)>MAXLEN% VDU 7:PRINT"Entry too long-"
;REP$
```

CONTINUED OVER

```
133IF LEN(inwd$)<3 VDU7:PRINT'"Entry too short-";REP$
134PROCcheckinput(inwd$)
135IF INEF%=1 VDU7:PRINT"Entry contains invalid chara
cter-";REP$
136IFsef%=1 VDU7:PRINT"Too many spaces-";REP$
137UNTIL INEF%=0 AND LEN(inwd$)<=MAXLEN% AND LEN(inwd
$)>2  AND sef%=0
138ENDPROC
139DEFPROCextvoc
140CLS
141REPEAT CLS
142PRINT"TYPE AN ENTRY-Entry='ZZZ' to finish"'''
143PRINTTAB(MAXLEN%);"*"
144PROCinwd
145WORD$(NOW%)=inwd$
146NOW%=NOW%+1:IF inwd$="ZZZ" OR inwd$="zzz" NOW%=NOW
%-1
147UNTIL NOW%=MAXWDS% OR inwd$="ZZZ" OR inwd$="zzz"
148ENDPROC
149DEFPROCdisp
150LOCAL I
151VDU 14
152REPEAT CLS
153FOR I=0 TO NOW%-1
154PRINT(I+1);". ";WORD$(I)
155NEXT I
156PRINT'''"'A'-To see words again:'M'-For Menu."
157PROCselectfrom("AM")
158UNTIL A$="M"
159VDU 15
160ENDPROC
161DEFPROCinit
162LOCAL I
163FOR I=0 TO MAXWDS%
164WORD$(I)=STRING$(MAXLEN%," ")
165NEXT I
166ENDPROC
167DEFPROCeditvoc
168LOCAL WDNO%
169CLS
170PRINTTAB(0,10);"Do you know the number of the entr
y"'''"to be edited ?(Y/N)"
171PROCselectfrom("YN")
172IF A$="Y" THEN REPEAT CLS:INPUT'"Enter the No. "WD
NO%: UNTIL WDNO%>0 AND WDNO%<=NOW%
173IFA$="N" PROCsch
174IF WDNO%=0 ENDPROC
175CLS
176PRINT"The current entry(No.";WDNO%;")is:-"'';WORD$
(WDNO%-1)
177PRINT'''"Type the ammendment or 'DEL' to delete"
178PRINT"or 'STET' to leave unchanged"'
179PROCinwd
180IF inwd$="DEL" PROCdel(WDNO%-1):ENDPROC
181IF inwd$="STET" ENDPROC
182WORD$(WDNO%-1)=inwd$
183ENDPROC
184DEFPROCdel(DLNO%)
185LOCAL I
186FOR I=DLNO% TO NOW%-1
187WORD$(I)=WORD$(I+1)
188NEXT I
189NOW%=NOW%-1
190ENDPROC
191DEFPROCsch
192LOCAL S$,I,B$,FLAG%
193REPEAT FLAG%=0
194REPEAT CLS
195PRINT"You can search for the entry by enteringa se
arch term consisting of up to ";MAXLEN%;'"letters and s
paces."
196PRINTTAB(MAXLEN%+13);"*"
197INPUTLINE"Search term ? "S$
198UNTIL LEN(S$)<=MAXLEN% AND LEN(S$)>0
199PRINTCHR$(12);"SEARCHING"
200FOR I=0 TO NOW%-1
201IF LEN(S$)>LEN(WORD$(I)) THEN 204
202IF INSTR(WORD$(I),S$) THEN PROChit(I)
203IF FLAG%=1 I=NOW%-1
204NEXT I:IF FLAG%=1 B$="M" ELSE PRINTCHR$(12);"NOTHI
NG FOUND-Press 'RETURN' to search"'"again or enter 'M'
 for main menu"':INPUT">" B$:IFB$<>""WDNO%=0
205UNTIL B$<>""
206ENDPROC
207DEFPROChit(B%)
208CLS
209WDNO%=B%+1
210PRINT"Found entry No.";WDNO%;''WORD$(B%)
211PRINTTAB(0,15);"Press:-"'
212PRINT"'E' to edit."
213PRINT"'C' to continue search."
214PRINT"'M' to return to main menu."
215PROCselectfrom("CME")
216IF A$="E" FLAG%=1
217IF A$="M" FLAG%=1:WDNO%=0
218IF A$="C" FLAG%=0
219ENDPROC
220DEFPROCsave
221LOCAL X,I,fnm$,A$
222CLS
223PRINTTAB(0,10);"Load a Tape for the data and then
press"':INPUT"'RETURN'when ready "A$
224REPEAT CLS:PRINTTAB(0,10);"What is this vocabulary
 file to be"'"called ?  ";
225INPUT"9 Chars. max. " fnm$
226UNTIL LEN(fnm$)>0 AND LEN(fnm$)<10
227PRINT'''
228X=OPENOUT fnm$
229PRINT#X, MAXLEN%,NOW%,MAXWDS%,FAILMAX%,CLAS$,PC%
230FOR I=0 TO NOW%-1
231PRINT#X, WORD$(I)
232NEXT I
233CLOSE#X
234ENDPROC
235DEFPROCload
236LOCAL X,I,fnm$,A$,d%
237CLS
238PRINTTAB(0,10);"Load the data tape and then press"
':INPUT"'PLAY' and 'RETURN' when ready "A$
239REPEAT:CLS
240PRINT"What is the file name of the vocabulary"'"t
o be loaded ?(Just press 'RETURN' to"'"load the first
file)"''
241INPUT"9 Chars. Max. "fnm$
242UNTIL LEN(fnm$)<10
243PRINT'''
244X=fnm$
245INPUT#X,MAXLEN%,NOW%,MAXWDS%,FAILMAX%,CLAS$,PC%
246DIM WORD$(MAXWDS%)
247PROCinit
248FOR I=0 TO NOW%-1
249INPUT#X,WORD$(I)
250NEXT I
251CLOSE#X
252PROCerr
253ENDPROC
254DEFPROCcoff
255VDU23,1,0;0;0;0;
256ENDPROC
257DEFPROCcon
258VDU23,1,1;0;0;0;
259ENDPROC
260DEFPROCwarn
261CLS
262PRINTTAB(0,10);"THE ACTION YOU ARE ABOUT TO TAKE W
ILL"'"DESTROY YOUR DATA IN MEMORY! ! !"
263PRINTTAB(0,20);"To continue enter 'CONTINUE' other
wise"'"press 'RETURN'."'''
```

```
  264INPUTTAB(11)wa$
  265ENDPROC
  266DEFPROCerr
  267LOCALA$
  268ON ERROR CLS:PRINT"ERROR"'''':REPORT:A$=INKEY$(1000
):CLOSE#0:GOTO24
  269ENDPROC
>
```

PROGRAM LISTING 2

```
    6ON ERROR CLS:CLOSE#0:PRINT"ERROR"''':REPORT:Y$=INK
EY$(1000):RUN
    7MODE 7:NOW%=0:CLAS$=STRING$(40," "):*FX200,1
    8SB$="*PRESS THE SPACE BAR TO START*"
    9DIMCC$(3):FORI=0 TO 3:READCC$(I):NEXTI
   10DATA No Clue.,First Letters.,Vowels.,Consonants.
   11PROCst(500)
   12REPEAT CLS:NWC%=0:NA%=0
   13IFNOW%=0 PROCload
   14ON ERROR OFF:PROCcoff:PROCshuf:CLS
   15REPEAT PRINTTAB(3,22);SB$:PROCst(10000):UNTIL A$="
 " OR A$="?"
   16IF A$="?" PROCchg:GOTO15
   17CLS:PROCvert(0,0,24,129):PROCvert(1,0,24,157):PROC
vert(2,0,24,146):PROCcoff
   18FORI=1TO15:PROChang(I):PROCdel(1500):IF I=14 PROCd
el(8000):NEXTI ELSE NEXTI
   19PRINTTAB(23,1);"HANGMAN";TAB(23,2);"_______"
   20PRINTTAB(17,3);"To survive you must";TAB(17,5);"fi
ll in the missing";TAB(17,7);"letters shown as '*'."
   21PRINTTAB(17,10);"Every time you guess";TAB(17,12);
"a letter wrongly your";TAB(17,14);"DOOM comes one step
";TAB(17,16);"nearer-GOOD LUCK !"
   22IFCLAS$<>"Not invoked." PRINTTAB(10,20);"THE ANSWE
RS ARE ALL";TAB(INT(18-LEN(CLAS$)/2),22);CHR$(136);CHR$
(131);CLAS$
   23PRINTTAB(4,24);SB$;
   24PROCselectfrom(" "):IFPC%<>1 PROCclue
   25FORTN%=1TONOW%:NG%=0:NA%=NA%+1
   26CLS:nl%=FNwdln(WORD$(TN%-1)):IF vo%=0 AND PC%=4 NA
%=NA%-1:GOTO 41
   27nc%=0:nw%=0:PROCscr:IF FAILMAX%<>15 THEN FORI=1TO(
15-FAILMAX%):PROChang(I):NEXTI:nw%=15-FAILMAX%
   28PRINTTAB(20,5);PT$:PRINTTAB(20,6);PT$
   29IFPC%=1 OR PC%=2 UL$=""
   30IFPC%=3 UL$="AEIOU"
   31IFPC%=4 UL$="BCDFGHJKLMNPQRSTVWXYZ"
   32PRINTTAB(2,23);UL$
   33REPEAT
   34VDU31,18,10,136,31,37,10,0,32:PROCselectfrom("ABCD
EFGHIJKLMNOPQRSTUVWXYZ"):VDU31,18,10,32
   35PRINTTAB(36,10);"";A$
   36IFINSTR(UL$,A$) VDU31,18,13,32,31,23,15,32,31,30,1
5:PRINTA$:PROCdel(4000):VDU31,18,13,152,31,23,15,152:GO
TO34
   37UL$=UL$+A$:PRINTTAB(2,23);UL$
   38PROCchk:PROCdel(1500)
   39UNTILnc%=nl% OR nw%=15
   40IFnw%=15 PROCdead:ON FLAG% GOTO27,41 ELSE PROCwin
   41NEXT TN%
   42CLS:PRINTTAB(0,6);"At the end of the game you corr
ectly"'''"completed ";NWC%;" words out of a possible"'''"
total of ";NA%;"."
   43PRINT'''"Do you want another game ?(Y/N)":PROCsele
ctfrom("YN")
   44UNTIL A$="N"
   45MODE7:*FX200,0
   46END
   47DEFPROCdel(x%)
   48LOCALI
   49FORI=1TOx%:NEXTI
   50ENDPROC
   51DEFPROCconv
   52IFASC(A$)>90 A$=A$+CHR$(ASC(A$)-32) ELSE A$=A$+CHR
$(ASC(A$)+32)
   53ENDPROC
   54DEFPROCchk
   55LOCALI,X$,x%,tnc%
   56PROCconv:tnc%=nc%
   57FORI=1TOLEN(WORD$(TN%-1))
   58X$=MID$(WORD$(TN%-1),I,1)
   59IFINSTR(A$,X$) PRINTTAB(19+I,5);X$:PRINTTAB(19+I,6
);X$:nc%=nc%+1:IFPC%=2 PROCflchk
   60NEXTI
   61IFnc%=tnc% nw%=nw%+1:PROChang(nw%)
   62ENDPROC
   63DEFPROCflchk
   64IFI=1nc%=nc%-1:ENDPROC
   65IFMID$(WORD$(TN%-1),I-1,1)=" "nc%=nc%-1
   66ENDPROC
   67DEFPROCwin
   68PROCdel(4500):NWC%=NWC%+1
   69CLS:PRINTTAB(7,10);"WELL DONE-YOU SURVIVED !":PROC
del(8000)
   70IFTN%=NOW% ENDPROC
   71CLS:PRINTTAB(3,10);"Do you want another word ?(Y/N
)":PROCselectfrom("YN"):IFA$="N" TN%=NOW%
   72ENDPROC
   73DEFPROCdead
   74PROCdel(3000):CLS:NG%=NG%+1
   75IFNG%=3 PRINTTAB(7,6);"LET'S GIVE THIS ONE UP"'''"T
he correct answer was:-"'';TAB(20-INT(LEN(WORD$(TN%-1))
/2));WORD$(TN%-1):FLAG%=2 ELSE PRINTTAB(13,9);"HARD LUC
K":PROCdel(3000):PRINT''" HAVE ANOTHER TRY AT THE SAME
WORD":FLAG%=1
   76IFNG%=3 AND TN%<>NOW%:PROCdel(3000):PRINT''TAB(7);
"LET'S TRY THE NEXT WORD"
   77PROCdel(8000):ENDPROC
   78DEFPROChang(x%)
   79LOCALI
   80VDU7:ONx%GOTO81,82,83,84,85,86,87,88,89,90,91,92,9
3,94,95
   81PRINTTAB(3,19);STRING$(11,CHR$(47)):ENDPROC
   82VDU31,4,15,255,255,10,8,8,255,10,8,255,10,8,255:EN
DPROC
   83 VDU31,11,15,255,255,10,8,255,10,8,255,10,8,255:EN
DPROC
   84PRINTTAB(6,15);STRING$(5,CHR$(96)):ENDPROC
   85PROCvert(4,9,6,106):ENDPROC
   86PROCvert(12,9,6,53):ENDPROC
   87PROCvert(4,3,6,106):ENDPROC
   88PROCvert(12,3,6,53):ENDPROC
   89VDU31,5,4,184,33,11,8,95,38:ENDPROC
   90VDU31,9,3,41,48,10,8,34,100:ENDPROC
   91PRINTTAB(4,2);STRING$(9,CHR$(124)):ENDPROC
   92PROCvert(8,3,6,106):ENDPROC
   93PROCman(8,9):ENDPROC
   94PRINTTAB(5,16);CHR$(136);"YOUR";CHR$(137):PRINTTAB
(5,17);CHR$(136);"LAST";CHR$(137):PRINTTAB(5,18);CHR$(1
36);"HOUR";CHR$(137):ENDPROC
   95FORI=16TO 18:PRINTTAB(5,I);STRING$(7," "):NEXTI
   96PRINTTAB(6,15);STRING$(5," "):PROCvert(6,15,3,53):
VDU31,6,18,165
   97PROCdel(2000)
   98FORI=9TO14:PRINTTAB(7,I);STRING$(4," "):NEXTI
   99PROCman(8,13):VDU31,8,18,174,173:PROCvert(8,9,4,10
6):SOUND1,-15,0,50:ENDPROC
  100DEFPROCvert(l%,y%,n%,c%)
  101LOCAL I
  102VDU31,l%,y%
  103FORI=1TOn%:VDUc%,10,8:NEXTI
  104ENDPROC
  105DEFPROCman(x%,y%)
  106VDU31,x%,y%
  107VDU8,149,126,125,146,10,8,8,8,8,149,107,183,146,10
,8,8,8,8,106,107,183,53,10,8,8,8,8,170,106,53,37,10,8,8
,8,8,154,106,53,153,10,8,8,8,8,154,122,117,153
  108ENDPROC
```

CONTINUED OVER

```
109DEFPROCshuf
110LOCAL I,r1%,r2%,A$,Z%
111Z%=RND(-TIME)
112CLS:PRINTTAB(9,10);"PLEASE WAIT A MOMENT":FORI=1TO
NOW%*2
113REPEAT r1%=RND(NOW%)-1:r2%=RND(NOW%)-1:UNTILr1%<>r
2%
114A$=WORD$(r2%):WORD$(r2%)=WORD$(r1%):WORD$(r1%)=A$
115NEXTI
116ENDPROC
117DEF FNwdln(WORD$)
118LOCAL I,sp%,con%,A$,x%
119PT$="":vo%=0
120FORI=1TOLEN(WORD$):A$=MID$(WORD$,I,1)
121IFINSTR("AEIOUaeiou",A$)vo%=vo%+1:PROCfud(3)
122IFINSTR("AEIOUaeiuo ",A$)=0con%=con%+1:PROCfud(4)

123IFA$=" " sp%=sp%+1:PT$=PT$+" ":IFPC%=2 I=I+1:PT$=P
T$+MID$(WORD$(TN%-1),I,1)
124NEXTI
125IFPC%=2 PT$=LEFT$(WORD$,1)+RIGHT$(PT$,LEN(PT$)-1)
126x%=LEN(WORD$)-sp%
127IFPC%=2 x%=x%-(sp%+1)
128IFPC%=3 x%=x%-vo%
129IFPC%=4 x%=x%-con%
130=x%
131DEFPROCfud(x%)
132IFPC%=x% PT$=PT$+A$ ELSE PT$=PT$+"*"
133ENDPROC
134DEFPROCst(t%)
135PROCcoff
136FOR I=5TO6
137PRINTTAB(11,I);CHR$(141);CHR$(157);CHR$(129);"HANG
MAN  ";CHR$(156)
138NEXT I
139PRINT TAB(2,13);CHR$(131);CHR$(136);"*Copyright***
**Alan G. Rowley*"
140PRINT TAB(8,16);CHR$(131);CHR$(136);"(C)JULY 1983"
141*FX15,1
142A$=INKEY$(t%)
143PROCcon
144ENDPROC
145DEFPROCselectfrom(ALLOWED$)
146*FX202,32
147*FX15,1
148PROCcoff:REPEAT A$=GET$
149UNTIL INSTR(ALLOWED$,A$)
150ENDPROC
151DEFPROCinit
152LOCAL I
153FOR I=0 TO MAXWDS%
154WORD$(I)=STRING$(MAXLEN%," ")
155NEXT I
156ENDPROC
157DEFPROCcoff
158VDU23,1,0;0;0;0;
159ENDPROC
160DEFPROCcon
161VDU23,1,1;0;0;0;
162ENDPROC
163DEFPROCscr
164CLS:PROCcoff:VDU31,0,2
165FORI=1TO18
166VDU135,157,146,10,13
167NEXTI
168VDU10,129,157,135,31,16,2
169FORI=1TO18
170VDU156,10,8
171NEXTI
172VDU31,3,5,141,10,8,141,31,17,5,129,157,135,10,8,8,
8,129,157,135
173PRINTTAB(17,10);"GUESS A LETTER ?"
174PRINTTAB(12,21);"**LETTERS USED**"
175PRINTTAB(17,13);CHR$(129);CHR$(152);"YOU HAVE ALRE
ADY";TAB(22,15);CHR$(129);CHR$(152);"TRIED"
176ENDPROC
177DEFPROCclue
178CLS:PRINTTAB(0,9);"To give you a start I have alre
ady done"'
179ON(PC%-1) GOTO 180,181,182
180 PRINT"the first letters of each word.":PROCdel(80
00):ENDPROC
181PRINT"all the vowels.":PROCdel(8000):ENDPROC
182PRINT"all the consonants."
183PROCdel(8000)
184ENDPROC
185DEFPROCload
186LOCAL X,I,fnm$,A$,d%
187CLS
188PRINTTAB(0,10);"Load the data tape and then press"
':INPUT"'PLAY' and 'RETURN' when ready "A$
189REPEAT CLS
190PRINT"What is the file name of the vocabulary"''"t
o be loaded ?(Just press 'RETURN' to"''"load the first
file)"''
191INPUT"9 Chars. Max. "fnm$
192UNTIL LEN(fnm$)<10
193PRINT'''
194X=fnm$
195INPUT#X,MAXLEN%,NOW%,MAXWDS%,FAILMAX%,CLAS$,PC%
196DIM WORD$(MAXWDS%)
197PROCinit
198FOR I=0 TO NOW%-1
199INPUT#X,WORD$(I)
200NEXT I
201CLOSE#X
202ENDPROC
203DEFPROCchg
204LOCAL W$
205W$="O.K. ?(Y/N)"
206REPEAT CLS
207PRINTTAB(0,10);"CLUE CONDITION-";CC$(PC%-1)
208PRINT''TAB(14);W$
209PROCselectfrom("YN"):IFA$="Y" CLS ELSE REPEAT CLS:
INPUTTAB(0,10);"Which clue condition(1 to 4) ? "PC%:UNT
IL PC%>0 AND PC%<5
210UNTIL A$="Y"
211REPEAT CLS
212PRINTTAB(0,10);"No. of wrong guesses giving hangin
g ";FAILMAX%
213PRINT''TAB(14);W$
214PROCselectfrom("YN"):IFA$="Y" CLS ELSE REPEAT CLS:
PRINTTAB(0,10);"How many wrong guesses for hanging ?"':
INPUT"(2 to 15) "FAILMAX%:UNTIL FAILMAX%>1 AND FAILMAX%
<16
215UNTIL A$="Y"
216ENDPROC
>
```

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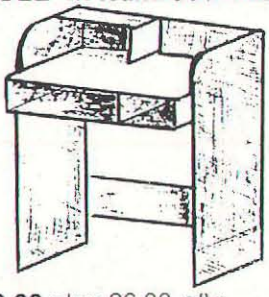

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A Clever Machine

Gordon Taylor

The Thorn-EMI Simtech Multitrainer spearheads the BBC Micro's move into industry. Gordon Taylor investigates.

With suitable software, the Beeb can be a very effective simulator of mechanical and electrical systems. This is because of its high speed, excellent colour graphics and the availability of a disc filing system — all at modest cost. The Beeb has therefore been chosen by Thorn-EMI Simtec as the basis of a simulator of both conventional (manual) and numerically controlled machine tools — known as the Multitrainer.

Reasons for using a simulator include a capital cost far less than for a real system and the ability to explore particular occurences — which might well be dangerous in the real situation — in complete safety. Perhaps the best-known examples are flight simulators but these reasons are also valid in the important field of machine tools, where recent developments have resulted in a greatly increased need for training.

Other advantages of machine tool simulation are:

The machining process may be visualised, even when — in the real machine — neither the workpiece nor the cutting tool may be viewed safely, due to coolant and swarf as well as the structure of the machine tool itself. This can be of particular value when the simulator is operated in parallel with a real machine tool.

The simulated machining process may be speeded up — or slowed down — relative to the real system and stopped and restarted at any intermediate stage.

MINI AND MULTIPACK

Simtec is one of the companies in the Engineering Group of Thorn-EMI(1). Other companies in this group make modems which can be used with the Beeb as well as Microdrives for Sinclair.

Much of Simtec's activity is in the defence field. They have — for example — supplied the Royal Navy with computer-based anti-submarine warfare simulators for 10 years and over 70 ships have been so equipped. However, another side of their business — equally well established — is machine tool automation. This includes digital readouts for one (Minipak) to three axes (Multipak) — the latter being programmable. These afford simple indication and intelligent, automatically advancing, indication respectively — which help the machine tool operator to achieve the required workpiece dimensions and so close the control loop.

MINI PAK

Such readouts may be fitted to both new and older machine tools. These usually have two or three-axis control of the cutting tool position, as in lathes and mills respectively.

The Simtec Multipak Micro-99 programmable data input unit contains its own microprocessor (a Z80), has its own "Flexipress" "key" input panel (for use by gloved or oily fingers) and three large clear 7-digit displays (for the X-, Y- and Z-axes).

The standard machining program storage capacity is 199 steps, which may be divided between up to 10 programs — with a maximum of 99 in any one program. In addition, up to 256 characters of text — e.g. remarks — may be stored for each program block, for a total of 2560 characters. The on-board memory has battery back-up for up to 28 days without mains power. Furthermore, programs may be written to and read from a cassette for long term storage. A printer can also be connected for listing the stored programs.

With this considerable capability, Simtec recognized the need for a training aid that would allow it to operate independently of the real machine tool — which may cost as much as £30,000. The Multitrainer therefore incorporates a standard Multipak data input unit, connected to three multi-turn, manual digital encoders to allow the movements of the cutting tool in the three axes to be imitated. All are mounted in a single, robust, reinforced plastic casing. This is coupled to a Beeb, running special software to accept and interpret user inputs and to display appropriate text and graphics. They are joined by a standard RS 423 serial data cable. The data input unit can also be disconnected from the three manual digital encoders and connected to a real machine tool, provided it is fitted with digital encoding measuring scales on the relevant axes. Thus both the operator and the machined part program may be fully exercised in the classroom. They may then be transferred — with the Multipak alone or the complete Multitrainer — to the machine shop.

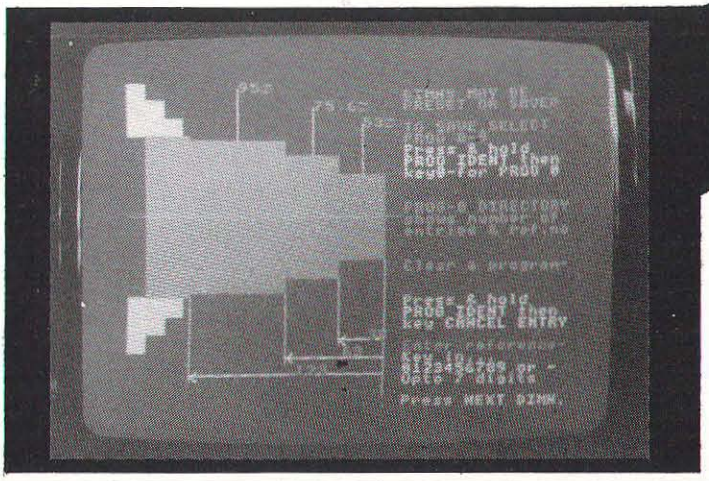
Hence the addition of a computer-based machine tool simulator to a data input unit may be seen as a logical extension of their two existing businesses — defence simulators and machine tool automation.

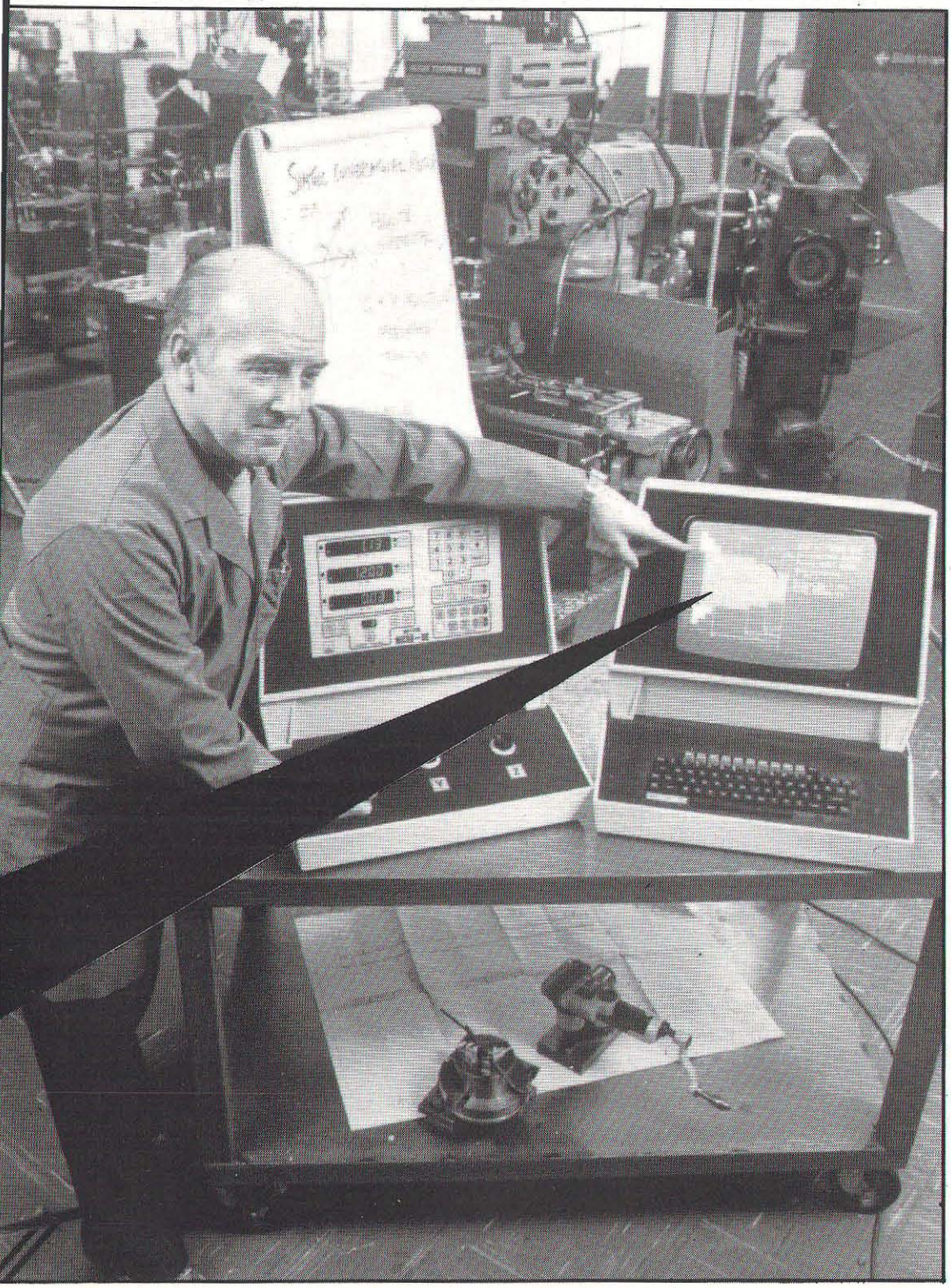
MULTITRAINER PACKAGE

The computer is also housed in a single robust casing. It includes the Beeb itself, a single 100K disc drive and a 14 inch colour monitor display. The same wide range of peripherals — e.g. joysticks, plotters and second processors — can be connected as to any other Beeb. For the Multitrainer, the most important are additional display screens — TVs or monitors — for larger audiences and an (Epson or similar) dot-matrix printer, both for listing stored part-programs and for dumping the screen graphics diagrams of the resulting machined parts.

The present Multitrainer package includes a 100K disc with some 83K of specially-written programs on it. These are organised in a main menu of nine items, four of which are expanded into sub-menus.

The first item has an introduction immediately recognizable by Beeb users, which leads into the main menu. Fortunately, for repeated use, this menu is accessible im-





Multi-trainer in use

mediately after loading — and at any time subsequently — by pressing the escape key.

The second item is pure test and describes the commands for programming the Multipak Micro-99. These include: Preset dimension, Inch/mm conversion, Add/Subtract, Datums and Signs, Absolute/Incremental Modes, Approach Distance, Resolution and Diameter, Memory Control Keys, Memory Description.

The third item gives a foretaste of the good things to come by illustrating the key components of a lathe with high resolution graphics (Mode 0) and then using smooth, rapid animation to show the three separate motions that control the cutting tool position in its two axes.

The fourth item deals with programming a part for machining on a lathe. In this case, the programs are entered using the above-mentioned commands, via the data input keys.

The three options in the submenu allow a prepared example to be displayed as a finished part, an own example to be entered and displayed and accompanying text to be entered and viewed. The workpiece is shown in the chuck of the lathe in simple elevation, complete with dimensions, while the prompts and program commands/inputs scroll down the right hand side of the screen. The prepared and own examples may be stepped through by using the space bar, to reveal the correct input at each step, along with the prompt for the next. Very good use is made of colours and flashing labels to aid clarity.

The fifth item uses animated graphics in a simulation of the actual machining of the workpiece on a lathe. The selection of the correct cutting tool can also be demonstrated as can the effects of selecting too large a cut, too fast a movement of the tool, or of programming a cut longer than the available material length. This last would result in a "chuck crash" and the illustration includes appropriate sound effects!

Items six and seven deal

CONTINUED OVER

with the programming of an example, and a matching exercise, for a mill — much as four and five did for a lathe. Again the motions — now in three axes rather than two — are illustrated, and in isometric projection. The differences between horizontal and vertical-axis mills are drawn.

During this example and exercise, the rectangular/cuboidal workpiece is shown in two views — plan and elevation — so that both the extent and the depth of cut are illustrated. Colour and animation (in Mode 1) are used to great effect to show the progress of the machining.

The last instruction item looks beyond the present capabilities of even the Simtec Multipak programmable readout unit to three types of computer numerical control (CNC). Whereas the present Multipak acts as an automated monitoring and display device for the human operator, CNC implies that the machine itself closes the control loop, according to pre-programmed instructions. Machine tools so equipped are of course, even more expensive and the case for training simulators even greater.

Three levels of CNC programming are demonstrated. The lowest — manual data input — is much as items four and six above, since there is very little difference in programming for automatic readout or for automatic control. The next level uses the special low level language known as G & M code.

HIGH LEVEL

This is comparable to the language used in programmable calculators or to Assembler and is usually loaded from paper tape.

The highest level ably illustrates the advantages of high level, interactive programming for machine tools. This uses the pre-programmed "intelligence" of the computer to provide most of the "technological" information — such as the speeds and feeds possible with various workpiece materials and cutting tools. Meanwhile, the part-programmer supplies only the essential, part-specific information — such as blank sizes and material, finished dimensions and surface finishes — in answer to questions. For this limited purpose, such high level, interactive, programming is much easier than using a conventional, general-purpose language such as BASIC.

Option on Peripherals

Again, these two higher levels of CNC are illustrated with excellent simulated machining operations, using high resolution graphics (Mode 1), colour and animation. For the former, the earlier mill programming example is repeated, but using G & M functions instead of manual input commands. For the latter, a second lathe programming example is shown, having a more complex form generated by roughing and finishing cuts.

The disc also includes utilities for formatting and backing up discs and for saving and loading part-programs held in the Multipak onto disc.

The screen displays are quite self-explanatory. However, a 13-page User Guide provides some additional information — including engineering drawings of the three machining examples and copies of typical text and graphics printouts.

Even for those who have no interest in engineering training, this software includes several fine examples of what is possible with today's Beeb.

FLEXIBILITY

Although Thorn-EMI Simtec is by no means the only supplier of digital read outs and other machine tool automation, all operate on similar principles so that the Multitrainer should be suitable for training on any system.

Simtec also appreciate that there is great potential for software extending beyond even the present scope. Indeed, the above-mentioned programs are intended largely to demonstrate this potential. A complete suite of training programs — on six discs — is currently being developed. These will cover all the main machining operations — such as drilling and boring, in addition to turning and milling. They will be available during the first half of this year and these additional programs will be equally usable in existing Multitrainer systems.

Furthermore, Simtec point out that the capabilities of the Beeb are still retained in full measure and that a wide and rapidly growing range of commercial software can also be run. As one example, they offer as an option "Wordwise" as a general-purpose word processor. This with the optional printer can be used for creating training course material and recording the results. As another option, they offer "Grafdisk" for simple computer-aided design (CAD) applications.

The above suggests that the Multitrainer can make a major contribution to the training — and retraining — of machinists in increasingly technological skills. This will become increasingly necessary as the cost of manufacturing automation continues to fall in relative terms while the demands for increased accuracy and productivity continue to rise. With the help of such training aids, based on a British computer and British software, any mechanical engineering organization should be able to match or better its competitors.

The complete Simtec Multitrainer costs £4960 (without options), which seems modest compared with the other investments that must be made — both in men (persons!) and machines (machine tools) — to stay competitive. Purchasers already include some of the largest engineering groups in the UK (such as British Aerospace and GEC) while overseas sales include a major order — worth some £400.000 — to equip a large number of polytechnics in Greece.

Reference (1), Thorn-EMI Simtech Ltd, Sellers Wood Drive, Bullwell, Nottingham NG6 8UX. Tel: 0602 273741. Telex: 37142.

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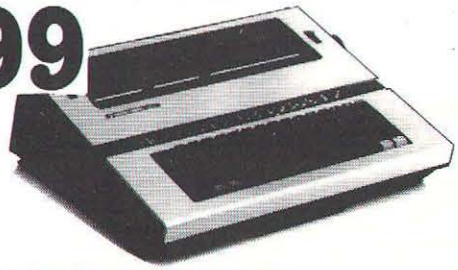

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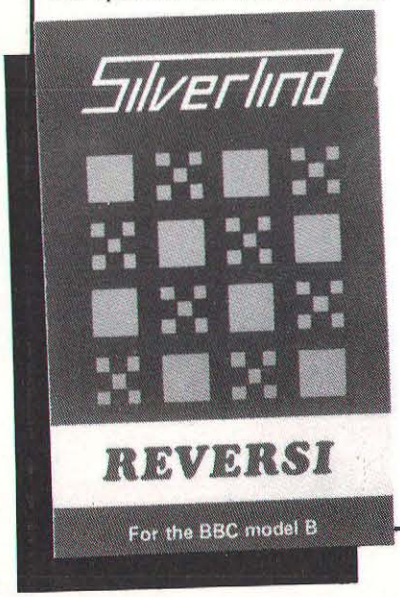
Software Reviews

Title	**Reversi**
Publisher	**Silverlind**
Machine	**Model B**
Price	**£6.95**

This is a version of the board game Reversi, also known as Othello. It is played on an 8x8 board, and the object is to trap your opponent's pieces at both ends on a horizontal, vertical or diagonal line. As a result of this, the trapped pieces are turned into the opponent's pieces. The player with the highest number of counters when the board is full is the winner. A move cannot be made if it does not capture any pieces.

The graphics are Mode 7; crude but effective; your pieces are displayed as crosses, the computer's as squares. Moves are entered using simple X-Y co-ordinates. Sound is used well: illegal moves are responded to with a loud discordant tone; each time a piece changes sides a quiet beep is emitted.

A great number of options are available. The computer will display, if requested, the time it takes to search for its move, the number of board positions it has looked at, and the number of moves it has looked ahead. This certainly brings home the computer's processing speed! Autoplay can be selected at any time; this means that the computer will play your moves as well as its own. However, once selected, this option is not reversible. The moves can also be listed out, and the Randomizer will avoid repetition of moves in the early stages of games.



The program is crashproof, and the computer responds quickly; the maximum response time on the highest skill level (level 57) is two and a half minutes.

Overall, I think that this game is excellent value; the many options and varying strengths of play should keep everyone, from novice to expert, happy.

Ratings Table:

GRAPHICS	50%
SOUNDS	60%
DOCUMENTATION	75%
VALUE FOR MONEY	85%
OVERALL	80%

Title:	**The Frog**
Publishers:	**Software For All**
Machine:	**Model B**
Price:	**£7.95**

There is nothing particularly original about this version of the tried and trusted Frogger game. As usual, the player must guide an innocent frog first across a busy street and then over a river, leaping onto stray logs and the backs of turtles in the latter case. There are the usual pitfalls such as being run down by fast-moving traffic or tumbling off the makeshift rafts into the drink. Also, there is a crocodile which drifts along with the current, waiting to gobble up the hapless amphibian. There is a time limit rather awkwardly displayed by a diminishing coloured bar rather than with numeric figures. Five frogs have to be safely taken to their lilypad havens within this time.

Although preliminaries and other routines such as calculation of high scores are programmed in BASIC, the bulk of the game is in Machine code. Some of the source is unassembled which immediately presents an unfavourable impression.

The game is rather fast and speed and congestion of the road increases as higher screens are reached. This, coupled with the excellent facility of being able to choose one's movement keys avoids the frustration of other versions of this game.

On the Graphics side, the program scores well, particularly with the representation of traffic; the cars are equipped with flashing headlights and are colourful and well-defined. The frog, however, is rather non-descript, bearing more resemblance to a grasshopper. To make up for the relatively modest array of colours available on the BBC micro, filling of shapes is frequently achieved by plotting adjacent pixels in different colours, thus obtaining a slightly different shade — this works quite well.

One of the apparent features of the program is the music — five different tunes are played at regular intervals whilst the action is occuring. They are however, rather disappointing being unharmonised and rather monotonous.

Overall, I feel that although visually quite pleasing, this game does lack the polish and outstanding features of most of the Acornsoft programs. Nevertheless, it is cheaper than many similar available cassettes, although at £7.95 it is hardly the outstanding bargain of the year.

Ratings Table:

SOUND	40%
GRAPHICS	70%
DOCUMENTATION	70%
VALUE FOR MONEY	55%
OVERALL	60%

Title	**Flexibase**
Publisher	**Alligata**
Machine	**Model B**
Price	**£9.95 - tape; £13.95 - disc**

Revealed: the other side of Sheffield based gamesters Alligata Software. Flexibase is a competent database system for cassette or disc system users with some nice features. The header accesses a set of printer options – Parallel, Serial and so on – and once selection has been made, loads in the main system.

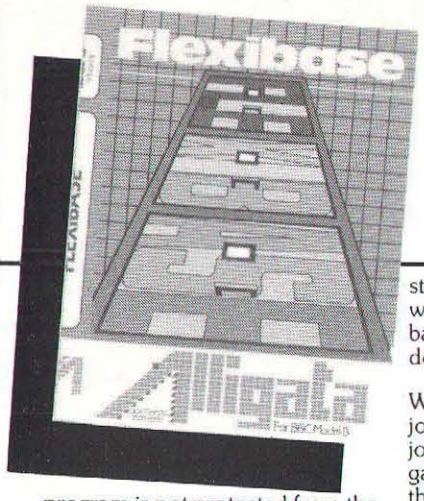
The first thing that strikes one is the presentation. The database is menu based and the main menu makes use of some violent colouration. This continues throughout the various option displays and is very useful in highlighting different choices. The colours are violent but carefully contrasted and therefore do the job.

A single key press moves the program on to the chosen option, and ESCAPE returns to the main menu except when saving, loading and sorting. Setting up the database for your software collection, rack of A&Bs or whatever is easy as pie. The current Record is updated automatically when you terminate each Record input with f0. The Record is split into constituent Fields which are terminated with a press of RETURN. The choice of keys is sensible and appropriate. There is however no facility to design the record display. It merely accepts a series of fields.

Amendments and deletions to records are made by referring to record and field numbers. A full record can be deleted by responding positively to a Y/N prompt. All potentially disastrous moves are checked first with a Y/N option just to make sure you are still awake. Any combination of records can be listed to the screen or to a printer, for the serious users among us.

The Search option has its own menu of powerful alternatives. You can 'set', 'reset' and 'invert' all records. These options select, deselect and toggle between the two, allowing considerable control over the records you wish to work on at any one time. The actual search can be done on the basis of several preselected criteria. Secondary searches can be executed with respect to previous selections. The two selections can be 'AND-ed' or 'ORed' – logical and powerful when you get used to the concept.

Sorting is carried out on fields, either the key field (the first) or selected fields in the prescribed order of importance. Saving and loading are simply prompts for filenames and a call to the cassette or disc filing system. Quitting the program reminds you that files need to be saved or they will be lost. The



program is not protected from the user and listing for study or amendment is available without having to break down some stubborn defence. A very solid system from Alligata which will not let down the purchaser. All the necessary checks are implemented for the sake of sleepy late night keyboard addicts. Record display is a bit boring but the search and sort options impressive.

Ratings Table:

GRAPHICS	N/A
SOUNDS	N/A
DOCUMENTATION	70%
VALUE FOR MONEY	80%
OVERALL	75%

Title:	**Galaxy Wars (Improved)**
Publishers:	**Bug-Byte**
Machine:	**Model B**
Price:	**£7.50**

Galaxy Wars is an arcade type game with three different stages of play. The first stage consists of a row of aliens (which look uncannily like three quarters of a beach ball) that move across the screen getting lower as the game progresses. These drop bombs at very regular intervals, and are backed up by unpleasant oblong creatures that swoop down at your base. If they reach the bottom of the screen they explode, forming a barrier which limits your movement for about five seconds.

The second stage has ships which drift aimlessly down the screen dropping the occassional megatonne fo missiles on their way.

The third stage is an old arcade favourite: the docking procedure. A colourful mother ship eagerly awaits the company of your laser base which you move left and right with the "TAB" and "Q" keys. If you succeed in this stage, you go back to stage one, with a different coloured background and new character definitions.

When you first load Galaxy Wars, it asks you if you are using joysticks or not. I found that joysticks, if anything, made the game harder, and so I stuck to the keyboard. The thing that I found most outstanding in this game is the quality of the sound. In the docking procedure, I thought that the sound was superb. Also, there is a very fast piece of colour changing when you get blown up. So, if you are going to make a habit of getting bombed, make sure that you are wearing sun glasses before you start playing. Unfortunately however, I felt that the game had little else going for it.

As a conclusion I would say that in the days when software for the beeb was quite scarce, this program would probably have done well, but today, there is so much software and it is of such good qaulity that it needs something really special to make the buyer reach for his wallet. This game is not bad and not brilliant, but there are much better games than this for £7.50. Interesting sound effects and quite good graphics, but this game requires a little more thought at the drawing-board stage.

Ratings Table:

SOUND	80%
GRAPHICS	50%
DOCUMENTATION	70%
VALUE FOR MONEY	50%
OVERALL	60%

Title	**Sea Wolf**
Publisher	**Optima Software**
Machine	**Model B**
Price	**£8.95**

The crew peered out helplessly onto the open waters. What was left for us? Our Lasers and Torpedoes were out of action, thanks to a cataclysmic battle with a destroyer; our present Energy level was so low that not even a warp back to home base was possible; the cabin pressure was rapidly plummetting below a tolerable level due to an oxygen leak; general morale was at an all-time low . . . and there was a menacing battleship homing in on us . . . there was no hope of survival . . . the Sea Wolf was doomed . . .

This real-time war game is very much based on the Atari program "Star Raiders". You are in control of the "Sea Wolf" and have ventured into troubled waters – an ambush from an array of enemy vessels is likely at any moment.

The game, which is completely in black and white, centres round the Ship's display which is in three parts. Firstly, the Long Range scan which shows the positions of other vessels and the home base with respect to Sea Wolf. The Short Range scan gives a radar display of the enemy position. Graphical simulation of battles is shown here. Finally, the computer output provides various information such as the state of your weaons, remaining energy, percentage damage to the ship and number of enemies killed (fifteen must be destroyed for the completion of a mission).

Encounters with other vessels are not fully animated – enemy missiles are not shown although there are appropriate graphical and sound effects when they are on target. Also, as you fire your weaon (either the laer which drains your ship's energy considerably, or torpedoes) all other motion ceases temporarily – this certainly detracts from the playability of the game.

Graphical characters are not particularly exciting – the enemy ships are shown as vague outlines whilst those appearing on the Long Range scan are rahter bulbous.

When your mission is concluded or you are destroyed, the Fleet Command – alias the computer – will assign you a new rank. This ranges from "Commander class five" if you were truly outstanding in all spheres or more probably the highly derogatory "Corpse class one" if you simply pottered about in a cowardly manner.

Overall, this is a fair program with a few interesting features but it really lacks the outstanding qualities that a topic such as this merits.

Ratings Table:

GRAPHICS	40%
SOUNDS	62%
DOCUMENTATION	70%
VALUE FOR MONEY	50%
OVERALL	60%

Title	**Canyon**
Publisher	**BBC Publications**
Machine	**Model B**
Price	**£10.00**

The scenario for Canyon reads 'You are the pilot of a small biplane, and the sole remaining active defender of the little mountain kingdom of Asdel against the invading robot tyranny of the Empire of Xar . . .'. Well you can forget about Asdel and Xar as you set out on this excellent game produced by A&B contributor Peter Voke. Indeed you can forget about everything for a while.

The game is in Mode 2 so the full colour palette of the BBC is employed. Some ingenious programming results in a hardware scrolling landscape forever changing shape and colour as it progresses through the screens of difficulty.

The multifarious robot invaders are politely introduced to us with the game instructions on a separate header program. They include Beamers, Bombers, Missile Boats and Proximity Mines. Then there's the gates of fire and finally the Imperial Flagship. The object is simply? to avoid these deadly objects or to destroy them with your laser cannon.

The most impressive feature of the game is the ability to make various choices about speed, width of playing area, number of enemy and so on. This effectively means that you have, in Canyon, a number of different games in one. Nor are the games easy especially at the higher speeds and concentration of enemy and

CONTINUED OVER

it presents a challenge to all levels of player. . The perfect family game. I have it on good authority that the manageress of George's Computer Shop in Bristol plays Canyon as her bedtime game. And she knows her games.

Ratings Table:

GRAPHICS	80%
SOUNDS	75%
DOCUMENTATION	85%
VALUE FOR MONEY	70%
OVERALL	85%

Title	**Snake Pit**
Publisher	**Postern**
Machine	**Model B**
Price	**£7.99**

This one is pretty addictive. You don't want to try again, you can't stand the thought of possible failure, but you still go ahead and press the S key.

The game is straightforward and it takes only a few moments to master the controls. These are the standard Z, X, : and / keys for horizontal and vertical movement. The gobbler which you control has an insatiable appetite for eggs and for each one he devours you get 10 points. Meanwhile your success is threatened by the red snake which roams free, eating eggs and consequently allowing its fellow reptiles to escape. All these snakes can gobble the gobbler so watch out.

When the gobbler does succeed in chomping all the eggs, the game speeds up and phse two begins. Now comes the chance for revenge. At this stage the gobbler can latch onto the tail of a snake and eat its way up to the head. It sounds gory but looks pretty clinical in the high-res graphics used here. 200 points are earned for each snake. Now, having eaten all the snakes you press S and the hissing starts again. This time you are in the new higher speed of phase two.

For this type of arcade game the graphics need to b clear and colourful and the sounds original and appropriate. In the first department Postern have produced an attractive and lively screen presentation. The snakes are luridly coloured and coil about pretty smoothly. Unfortunately the sound is another matter. What I assume is supposed to be hissing sounds more like two bits of sand-paper being ground together. It might be nice if we were given the option to turn this down or even off.

All in all then an entertaining arcade type game. I'll just have one more go.

Ratings Table:

SOUNDS	50%
GRAPHICS	75%
DOCUMENTATION	85%
VALUE FOR MONEY	75%
OVERALL	75%

Title	**Filer**
Publisher	**Program Power**
Machine	**Model B**
Price	**£9.95**

FILER is a most useful piece of software for those BBC micro owners who want to use their machine for more than arcade games. As the name suggests it is a file forming/handling program, in which the operator can input the name of a file, the number of fields in the file and the number of data items in each field. An impressive range of operations can be performed on these files via the funciton keys and include such things as sorting and printing out the pages of the file.

As you would expect from Program Power, the programming itself is superb with clear menus, fast response and no apparent bugs. This alone makes the program well worth buying, since it achieves exactly what it claims to do. There are however a few less than perfect features.

Firstly, I know that Filer is aimed at the serious user rather than the graphics and colour mad arcade player, but I do feel that a small amount of colour to liven up the display might not have gone amiss. Secondly, there was no eycatching title page while the program loaded and all the text was in readable but rather mundane white. These are only minor intrusions and as a whole the program is excellent and represents good value for money.

Ratings Table:

GRAPHICS	N/A
SOUND	N/A
DOCUMENTATION	65%
VALUE FOR MONEY	85%
OVERALL	75%

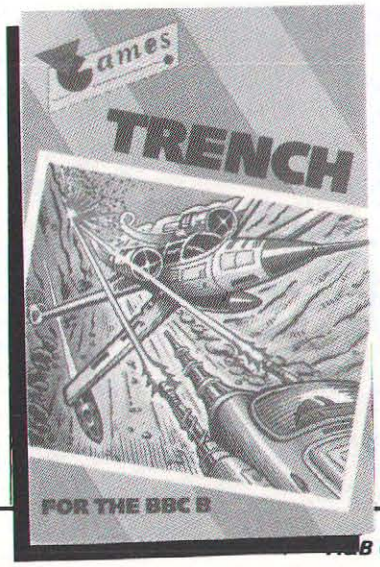
Title	**Trench**
Publisher	**Virgin Games**
Machine	**Model B**
Price	**£7.95**

Imagine you are Luke Skywalker sitting at the controls of your X-Wing fighter travelling down Darth Vadar's Death Star. You have been sent on a do or die mission to try and destroy the Star but the only way to destroy it is to travel down a 90 miles trench.

Along the trench are gun emplacements firing at you from all directions. Enemy Tie fighters are also chasing you, trying to make you crash into the side of the trench or to make you leave the trench by flying too high.

As you get closer to the vent your on-board attack computer is turned on. once the vent is in sight, cooly line up your sights over the opening and fire.

Virgin Games have not made a bad job of reproducing the scenario and action made famous by the Star Wars film. Some areas of improvement night include the inclusion of a laser gun in your X-Wing and not just the all important missiles. At present the only way to escape the enemy fighters is to try and dodge them. It's very hard even at skill level one (out of nine) and can become quite annoying but the graphics are good and colour well used, so in this case it is possible to translate annoyance into a challenge to your skills..



Ratings Table:

GRAPHICS	70%
SOUNDS	50%
DOCUMENTATION	70%
VALUE FOR MONEY	60%
OVERALL	60%

Title:	**JR**
Publishers:	**Software For All**
Machine:	**Model B**
Price:	**£6.95**

JR is a very interesting 2-player game. As the name suggests the game is about oil. The idea of the game is to become the richest oil tycoon by outdrilling, outselling and outmanoeuvering your opponent. You must bankrupt him by exploring, drilling, researching and repricing, as well as controlling your workers.

You must cope with many problems, for instance pay demands strikes, blowouts and tanker spills.

When the game starts, each player is asked the name of his company. The computer chooses who is going to go first. Each player has one turn, in which he may explore, drill, reprice his oil, research, alter his workforce or pass over to his opponent.

By exploring you find how deep oil is and how much there is. You may then decide to drill. By putting money to research you may reduce your drilling costs. You may need to employ or remove workers (if the union will let you) as your oil-field expands. Depending on what wage you pay, this task may not be easy.

Each turn you are given data such as cash holdings, flow of oil, reserves, sales, costs, profits, return, wages and the number of wells you own. You will need to be careful in your wages and pricing policies if you want to remain in business.

The game is run un MODE 1 and has a split-screen display; in addition an oil-well to show progress at your current site. Con-

sidering the type of game, the sound and graphics are average, but nothing too spectacular on this line.

Altogether a lively and interesting family game.

Ratings Table:

SOUND	45%
GRAPHICS	45%
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	70%

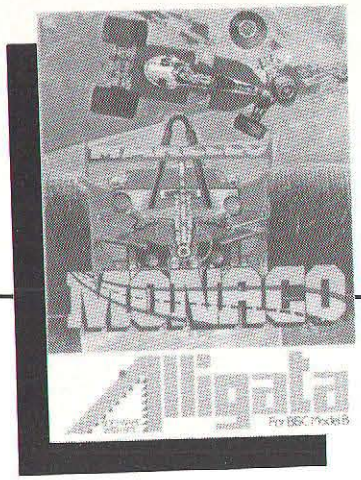
Title	**Monaco**
Publisher	**Alligata**
Machine	**BBC Model B**
Price	**£7.95**

Although this new racing game from Alligata is very nippy, it remains rather one dimensional. The graphics are well drawn and movement is as smooth as you would expect it to be harnessing the BBC's hardware scrolling capability. However it really is only a matter of going full tilt in one direction on the sort of straight highway you find only in a desert and the three keys (Z for left, X for right and RETURN to accelerate) indicate the scope of the game.

There are certainly plenty of other cars around to get in the way of your rapid progress. They do little manoeuvring but sometimes dramatically and without warning swerve into your path as you attempt to squeeze by. Unfortunately there is no brake facility so it is important to take it easy when encountering traffic up ahead since it is all too easy to fatally shunt into the rear end of a fellow traveller.

The most difficult aspect of the game is avoiding the – wait for it – ambulances which come speeding up from behind, sirens blaring. This aural warning sets the hairs standing on the back of the neck as you wonder from which direction the ambulance is coming. A most surprising and disarming element, since the ambulances don't pick you up, they run you down!

The game then is fun to play and attractive to watch. The colours are certainly well chosen. However it does not compare well with car racing games which



offer alternative track patterns, three dimensional effects, great changing and braking. Fast and furious but eventually monotonous.

Ratings Table:

GRAPHICS	70%
SOUNDS	60%
DOCUMENTATION	60%
VALUE FOR MONEY	75%
OVERALL	70%

Title:	**Zombie Island**
Publishers:	**Software For All**
Machine:	**Model B**
Price:	**£6.95**

If I had to sum up "Zombie Island" in one phrase, then "lack of versatility" would probably be my chosen line; really about the best thing I can say about it is that it is a promising program in its infancy? Confused? Well I'll elaborate.

Our human friend is depicted as a rather unglamorous stick man who moves without flexing a muscle. He is pursued by several round characters which are apparently zombies. He has to move around the island avoiding their path and also keeping clear of the potholes that are to be found at regular intervals.

There is no firing routine (surely our hapless figure could have been armed with some sort of gun with which to defend himself?) so the game becomes grossly tedios after a handful of tries.

Graphical display is achieved entirely by block printing so predictably, the screen is bare and unexciting. Mode one has been used; I'm sure use of the full colour palette in Mode two would habe livened up the visual side of things.

The game has a few interesting features but they are too few in number and far between. The unusual but effective sounds (supplemented with carefully chosen enveloping) cannot compensate for overall deficiencies but they do show that with more time and care, this might have been a good package.

Ratings Table:

SOUND	60%
GRAPHICS	35%
DOCUMENTATION	45%
VALUE FOR MONEY	40%
OVERALL	40%

Title	**Pentiles**
Publisher	**Silverlind**
Machine	**Model B**
Price	**£6.95**

Pentiles is a strategy game in which you have to fit combinations of 8 different tiles (Pentiles) onto various sizes of playing area. Points are awarded depending on the time you take, and how many spaces left in the playing area.

Each pentile can be rotated either four or eight times depending on the shape of the tile; with the exception of the 'cross', which does not need to be rotated as it is symmetrical. Shapes are rotated by pressing a key, then the pentile is moved into position with the cursor keys, and 'fixed' in place with the COPY key. The depth (really the vertical width) of the playing area can be altered. The length alters proportionally to the width, therefore there are always the same number of spaces on the board.

There are three skill levels. On level one the area can be covered by 12 Pentiles, but the player is given 15 to allow for mistakes and misjudgements. A bonus of 200 points is awarded for using all of the types of Pentile. At this level, all pentiles are worth 20 points.

Level two allows you only 12 pentiles, but three can be 'bought'. This variation lets you choose from five pentiles displayed. After five turns in this manner, the computer allows you to change any of the five pieces; however each change 'costs' five points.

Level three is the same as level two except that after each move, a barrier across the screen builds up until you are no longer able to move your pentile into position.

The final score, if good enough, is displayed along with your name on a top five high score table. Sound is well used, and graphics are fairly good in Mode 5.

Pentiles is a good game with excellent response times for a BASIC program: good value.

Ratings Table:

GRAPHICS	60%
SOUNDS	60%
DOCUMENTATION	70%
VALUE FOR MONEY	75%
OVERALL	70%

Title	**Galactic Wipeout**
Publisher	**R.H. Software**
Machine	**Model B**
Price	**£8.95**

The RHS logo is a funny but effective title page for this rather standard space game, the sort of thing which comes in a much superior form the dedicated games machines. Having said that, this game uses the BBC's sound and colour qualities very well and I imagine that seasoned gamesters will have much fun trying to high score in this galactic shoot out.

The rather small spaceship moves (SHIFT) into position to attack the enemy hoardes which are indicated on a radar screen. When in range the ship fires (RETURN) and swings left and right (Z,X). All this action takes place in a peculiarly french blue sector of deep space.

The game is fairly difficult to play because of the small size of the graphics characters. Lining up shots is awkward and the firing rate not fast enough to allow continuous firing while swinging into position. The action is reminiscent of Acornsoft's Starship Command. The best method of play seemed to be to take things very slowly and to play a defensive waiting game. Not the most exciting prospect.

It is rumoured that RHS are intimately connected with Chris Curry and Herman Hauser of

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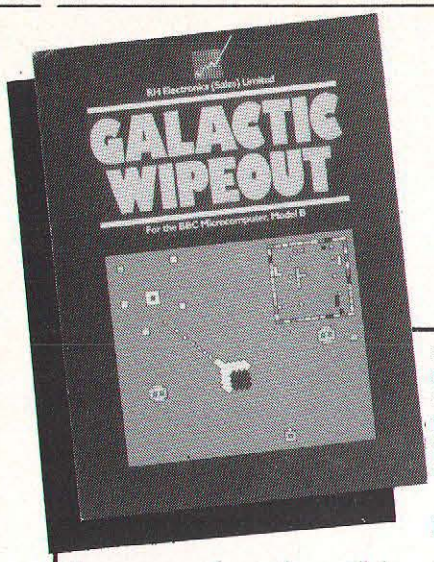


Acorn so perhaps they will be concentrating on the games market for the BBC (especially with the lower price tag) while Acornsoft move into serious and general interest applications. Unfortunately this particular game isn't essential collecting for the BBC owner and there are more original versions of this ilk available on the market. The most attractive feature unfortunately is the colourful packaging.

Ratings Table:

GRAPHICS	60%
SOUNDS	55%
DOCUMENTATION	80%
VALUE FOR MONEY	70%
OVERALL	70%

Title	**Row of four**
Publisher	**Software for All**
Machine	**Model B**
Price	**£6.95**

This strategy game takes place on a 7x6 board, which should be imagined as being vertical. Counters are 'dropped' alternately by the computer and the player until either has made a row of four counters either horizontally, vertically or diagonally.

Graphics are very good, the counters actually look like counters, and they drop very smoothly down the screen, the volume of the sound cleverly increasing as the counter nears the bottom. It is really a one sided game, as the computer has a perfect (as far as I know!) strategy. Moves are selected by pressing the number key corresponding to the row which you wish to drop your counter down. Crashproofing is excellent, except for one thing: the ESCAPE key is not disabled, which can be a nuisance when your hand slips.

Despite the good graphics and sound, I tired quickly of this game, because the computer is so good and there is no two player option. I think that Row of four is best kept as a board game off the computer.

Ratings Table:

GRAPHICS	70%
SOUNDS	60%
DOCUMENTATION	N/A
VALUE FOR MONEY	55%
OVERALL	50%

Title:	**Shrinking Professor**
Publishers:	**A&F Software**
Machine:	**Model B**
Price:	**£8.00**

You are a professor. A potion you were mixing slips from your grasp, and you are overcome by smoke. When you finally wake up, you are rather distressed to find yourself less than one inch high. Your only hope is to reach the crystals at the top of the lab-table, which will restore you to your original height.

This task is not quite as easy as it sounds, however. There are a number of obstacles that must be overcome on your way to acquiring the valuable crystals. As you are only tiny, everything towers over you; even mouse footprints look huge! There are 55+ locations, including a river, a vole's hole, a busy road, a rose bush, a broom cupboard, and ants' nest and a compost heap(!) There are many objects such as a sliver of metal, a screw, some D.D.T., honey and a whole host of other interesting things. You will, of course, need to be able to connect things, and in this respect I found the adventure easier than some I have tried.

There are several commands, such as the usual North ect., as well as left and right. There are also a large number of undocumented commands, but as the program says, use your brain! There is a help command but I found it to be less than useful.

The program itself is written in BASIC and, with a small amount of effort, may be listed if you want to cheat. Don't! I did the whole thing without cheating and it's much more fun. The program is &61FF Blocks long, and takes five minutes to load.

The program is good overall, and one which I would consider buying if I was an adventurer (*I* am!)

Ratings Table:

SOUND	50%
GRAPHICS	N/A
DOCUMENTATION	70%
VALUE FOR MONEY	70%
OVERALL	70%

Title:	**Galaxians**
Publishers:	**Software For All**
Machine:	**Model B**
Price:	**£7.95**

All software manufacturers start by stocking a number of standard games. They normally can offer home computer versions of the standard arcade games of Pac-man, Space Invaders, Frogger and Galaxians. This game falls squarely into this category.

Little instruction need to be given with the 'shooting gallery' type of game, and little is given. The only instruction on the cassette is to use *RUN in order to load. Loading was accomplished successfully, though the computer turning the cassette motor off after each block has loaded becomes tedious.

Full instructions are offered at the start of the game. These comprise which keys are used to move and fire the laser, and a breakdown on the points scoring for each target. A degree of difficulty between 1 and 6 is available, merely seeming to change the number of targets you start with, and the number of bombs they drop.

The aliens move from side to side slowly dropping bombs from time to time, before diving down at your position. Your job is either to shoot them with your laser or avoid them. As each screen is cleared another screen appears with increasing numbers of aliens in attack formation. Additional lives are added to the initial 3 at 10000 and 20000 points. More points are scored for hitting an alien on the dive, than for picking one out of the formation.

After playing the game for only a short while, it became clear that nothing particularly new was happening. A screen of aliens was replaced with another screen of aliens. Maybe there were a few more, and maybe they dropped more bombs, but all types of aliens were on the first screen. This made the game pall very quickly.

This may be a reasonable interpretation of the original game with good graphics and ear-piercing sound, but the overall game lacks a significant factor, how to retain your interest after more than a few goes.

Ratings Table:

SOUND	75%
GRAPHICS	80%
DOCUMENTATION	65%
VALUE FOR MONEY	75%
OVERALL	75%

Title	**Ski Slalom**
Publisher	**R H Electronics**
Machine	**Model B**
Price	**£8.95**

Ski Slalom is a great game, if a little on the quick side for an inexperienced game player. Some sort of skill level selection would have been a good idea. My unique method of getting huge scores was to RUN the game on the Electron which slows it down just nicely. However I don't recommend this course of action to any Electron owners since I'm sure RHS will come up with a dedicated version some time in the future.

The Jean Claude Killy/Franz Klammer figure is kitted out with all the standard skiing gear (actually more the bunny slopes than world championship) and the poles and skis move convincingly as he progresses. Negotiating the slalom course is not easy but whatever the outcome the actual skiing is realistic. The knees are bent, the skis parallel; the weight is transferred to the edges as the figure turns into gates.

Nasty spills are all too easy and occur mainly when he either hits a gate (even if it is only with the bobble of his wooly hat), or when he comes a cropper on the snow with a turn which was just that bit too tight. There are also particularly icy spots on the

course which cause a degree of instability.

The astounded player also finds that some biased fanatical supporter throws the occasional snowball which usually results in the demise of his star skier. The said snowball comes hurtling out of the background and is extremely difficult to avoid. If you do manage it then you may well make the high score table which begins at 1,000.

The control keys are simply up/down and slow/fast. The sound closely mirrors the countdown and ski noises and the graphics are colourful and smooth. A super game for the winter. It's not easy but that reflects the reality of the sport.

Ratings Table:

GRAPHICS	90%
SOUNDS	85%
DOCUMENTATION	80%
VALUE FOR MONEY	90%
OVERALL	90%

Title	**Monsters**
Publisher	**Acornsoft**
Machine	**Model B, Electron**
Price	**£9.95, £9.20**

Anyone who has played and enjoyed the game "Space Panic" in an arcade will find that Monsters is quite a good game. The idea of the game is to kill off monsters by burying them. There are walkways and ladders for your man to run along. You have a shovel with which you can dig holes into which the monsters fall. When a monster does fall, you must quickly fill the hole in. If you fail to do so, he will be more powerful when he forces his way out of the hole. You have a limited oxygen supply, and as it is used up, you will not be able to run or dig as quickly.

On the first screen there are just three monsters. After this, you will find that it is not so easy. After a couple of screens, a green monster arrives. He has to be knocked through two levels. The white one who appears later must fall three levels before he is killed. They are very hard to kill. However, any two monsters can be killed by dropping one on to the other. This fact is very useful to know. After about four screensful you gain a free life which you will need very soon afterwards. The game speeds up considerably at this point and you have to be very quick to avoid disaster.

The graphic quality of the game is good but not outstanding. The man really runs and the monsters look very mean. This is one type of game where graphic talent on a machine can not easily be shown, and Monsters does not show it!

The game is let down a little by the sound. There is nothing remotely exciting at all in this category. I feel that a little more should have been done to improve the quality of sounds.

The controls pose another problem. They are the standard ZX?*, but the dig + fill are operated using d+f which are too far away to be used easily. You have to take your hand off one set of controls to dig or fill and this can lead to problems. I have suffered many an untimely death due to this. Joysticks cannot be used unless you alter the program as in A+B Computing. I feel that this is a valuable addition to the game.

Summary: Good but expensive at £9.95. Not as refined as it should be.

Ratings Table:

GRAPHICS	60%
SOUNDS	50%
DOCUMENTATION	?%
VALUE FOR MONEY	50%
OVERALL	60%

Title:	Felix In The Factory
Publishers:	Program Power
Machine:	Model B
Price:	£7.95

This game is the latest release from Program Power. It is completely different from any game I have seen and is highly original. The object of the game is to keep a generator filled with oil. If the oil-level drops too low, the lights in the factory flicker and the generator will stop. Felix is the hero who must obtain the oil. To do this he must first negotiate a conveyor belt and the packages on it. Then he climbs a ladder and tries to avoid three gremlins sent to kill him. This he does either by running or by using a pitchfork with which to spear the gremlins who fall down and die. A further hazard is a rat which appears from time to time. A bag of rat poison (which can be left on any level) has been thoughtfully provided so you can kill the rat.

The controls are A; Z; £; cursor down; and cursor up to jump on the conveyor belt, and to get high-up objects. Once you have reached the oil you must Felix back to the generator with the oil can, whereupon the game starts again but with more gremlins.

Graphically, the game is very good. All the children look real and all movement is as smooth as it could be. The multi-coloured graphics facility has been well used to provide a colourful game. The rat is especially realistic.

The sounds are excellent. The generator hums away happily to itself, a "boing" is produced when Felix jumps, and the squeaking rat has to be heard!

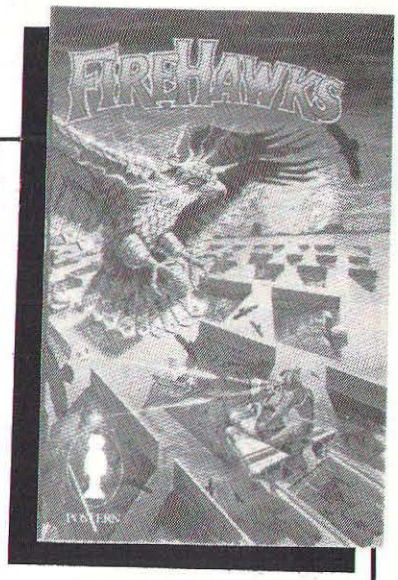
The instructions given are also very good. They are on the cassette insert card and are very clear. They include full loading instructions, and advice if you have loading problems. My only cause for complaint is the fact that the game is so hard!

Ratings Table:

SOUND	85%
GRAPHICS	85%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
OVERALL	80%

Title	**Firehawks**
Publisher	**Postern**
Machine	**Model B**
Price	**£6.95**

Another shoot 'em down game for the Beeb. At first sight this did not seem all that encouraging despite the excellent packaging. However Firehawks proved to be fast fun and extremely addictive. The format may not be too different from other such two dimensional dash across the bottom of the screen and fire games but Firehawks had that professional arcade edge which is hard to define:



It is very fast if you want it to be, with 15 different levels of speed to choose from and the same number for 'difficulty'. Level one just zaps down the screen and you can hardly see it so there must be some big delay loops for the easier levels. The grid of defences are randomly generated for each session and this adds to the enjoyment as the firehawks buzz down the screen wings flapping, a deadly swarm. Rather macabre is the way in which the odd wing remains flapping in space after the rest of the character has been blasted away. I doubt whether this is intentional.

The background colour and the Firehawks are also randomly painted but the best bit of graphics is when you finally succumb to the attack and the Phoenix rises to a glissando of notes and generally ecstatic noises.

The general game playing method is to blast through the walls to get at the Firehawks (they only take one blast). They also munch their way through the defences as they advance. A good tactic is to cover the holes that appear in the walls but it often comes down to a one to one conflict near the bottom of the screen. It's difficult hanging on. Maybe that's why I like it.

Ratings Table:

GRAPHICS	75%
SOUNDS	75%
DOCUMENTATION	70%
VALUE FOR MONEY	80%
OVERALL	75%

Earth Battle

P.J. Kenworthy

Battle it out in 3D with the invading alien force. Earth is doomed but the human race may yet survive.

Earth Battle is a relatively short (4K) program designed on a BBC Model B OS.1.2. Using MODE 2 graphics (hence the need for the Model B), the program is a space game with a slight variation from the rest.

The scenario is that of a doomed Earth, having been reduced to a smouldering pile of ashes by the superior invading aliens. The last of the surviving inhabitants are being evacuated via space shuttles to communes on the moons of Mars. The task has nearly been completed. However, the long range scanners indicate that yet another wave of aliens are approaching.

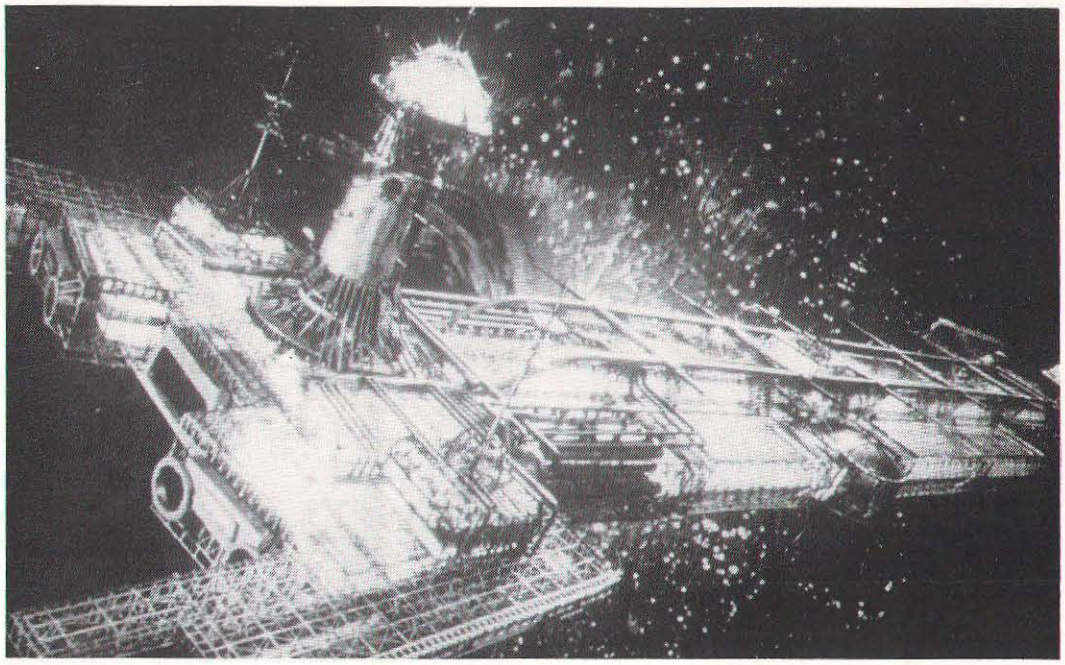
The player commands the sole remaining laser battery, situated behind a nearby mountain range. The battery is protected by a force field, but this will be gradually eroded away by the aliens' own lasers. The battery's own fuel source to the lasers will not last for ever. However, while these resources last, the aliens will only attack the player and not the remaining inhabitants. Therefore, it is the player's job to present to the remaining people of earth as many minutes as possible to get away before the planet is totally anihilated.

HOW TO USE THE PROGRAM

To use the program is extremely simple. When running, the controls are as follows. Up/Down and Left/Right are controlled by the cursor keys. These are used to target the laser sights on the screen. To fire the lasers the space bar should be depressed.

By changing lines 240 and 330 to 370 it should not be too difficult to change the keys which produce movement if you want to use Z,X,/,: or some similar combination. The necessary values are in the User Guide.

At the bottom of the screen the mountain range behind which the battery is situated is displayed. At the top of the screen, the levels of fuel and energy remaining for the lasers and force-field respectively are shown, together with the length of time for which the player has been in combat.



Only one alien is shown at any one time. This will move all round the screen altering in size as it does so. Every time it fires its lasers at you, the player's force-field loses three units of energy. Every time the player fires his/her lasers four units of fuel are used. For every five aliens hit, the energy reserves of the force-field are partly regenerated. However, there is no way of reclaiming fuel used up by the use of the battery's lasers. It is therefore sensible not to keep the space bar depressed continually. The best mode of attack is to wait until the alien crosses the sights and then fire. If this is not done, the player may be placed in the unfortunate position of running out of fuel for his/her lasers while still having some energy remaining in the force-field. If this occurs, all the player can do is sit back and watch the force-field being eroded away without being able to do anything about it.

At the start of the game, the player has seven hundred units of fuel for the lasers, and two hundred and fifty units of energy for the force-field. At the end of the game the score and the current high score are displayed, together with an option to play again.

PROCedures used in EARTH BATTLE

PROCINSTRUCTIONS
Displays instructions for game.

PROCMOUNTAINS
Used at beginning of game to draw in a mountain range at the bottom of the screen.

PROCSTARS
Used every time an alien is destroyed, to plot new stars in random positions on the screen.

PROCSA
This routine generates the position of a new alien and re-initialises the necessary variables.

PROCALIEN
Deletes the position where the alien was last, alters its size and then draws the alien in its new position. (Thus giving the visual effect of motion in three dimensions).

PROCMOVE
According to which key has been pressed by the player, this routine either alters the x,y co-ordinates of the laser sights, or fires the laser.

PROCDISPLAY
Displays the laser sight on the screen.

PROCFIRE
Draws in player's laser bolt with accompanying sound effect, pauses for an instant then deletes it again.

PROCALIENFIRE
As above, but for the alien instead.

PROCALIENEXPLODE
When the alien is hit, this routine simulates the explosion on the screen, sets up a new alien and restarts the game.

PROCTIME
Works out, then displays in minutes and seconds, how long the game has been going on for.

VARIABLES USED IN EARTH BATTLE

SPECIALISED VARIABLES

P%	=	Fuel left for lasers
SH%	=	Current strength of shields
A%	=	Player's choice of direction of movement etc.
ZZ	=	Time at point when game was suspended
X%,Y%	=	Current position of laser sight on screen
P1%,P2%	=	Current position of Alien on screen

COUNTERS

AL%	=	Number of aliens killed (modulus 5)
HISCORE	=	Highest score so far

GENERAL VARIABLES
K1%, K%, X1%, X2%, Y1%, M%, M1%, J%, J1%, F, PP, C%, C1%

GENERAL STRINGS
A$

PROGRAM FEATURES

Apart from the following exceptions, Earth Battle should prove no problem in its conversion to other systems.

MODE 7: The teletext mode on the BBC Computer, offering a text-only format of 40 x 25. In this mode, CHR$(141) generates double height characters, CHR$(136) makes whatever follows on that line flash on and off while CHR$(129) to CHR$(135) produces text of different colours.

MODE 2: Graphics Mode 2, using 30K of available memory space. Provides for 16 different colours, a text format of 20 x 32 and a graphics resolution of 160 x 256.

VDU 19,X,Y,0,0,0 : Command telling computer to exchange logical colour X for Y.

VDU 28,0,3,19,0 (LINE 100): Sets up text window which is three lines deep and nineteen characters wide at the top of the screen.

PROCXXX: Carry out procedure XXXX. Can be replaced by GOSUB / RETURN on other systems. However, the PROCedure routines run faster.

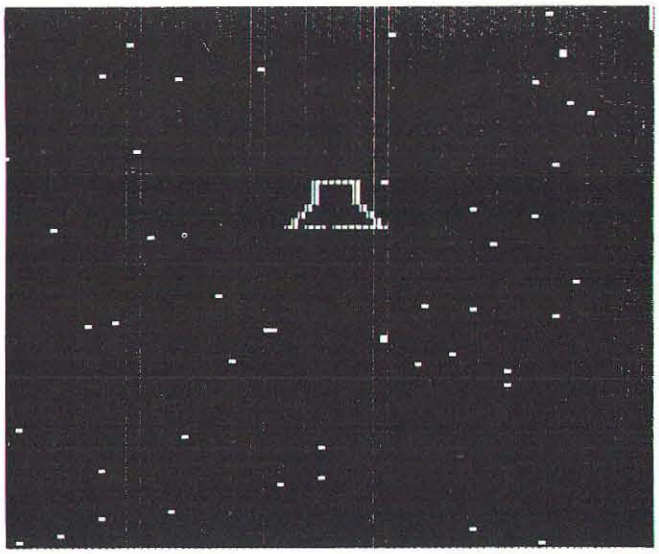
VDU 23: Used to create user-defined characters.

VDU 24,a;b;c;d; : Sets up graphics window. Graphics will then only appear in the area a from left-hand margin, b from top of screen, c away from left-hand margin and d away from top of screen.

*FX4,1: Disables the cursor-control keys, thus enabling them to be used as direction controls in the game. (When pressed, they return values between 136 & 139). *FX4,0 returns them to their normal purpose.

*FX11,1: Sets period before auto-repeat to 1/100 of a second.

*FX12,1: Sets auto-repeat of keys to 1/100 of a second.



*FX12,0 resets both of the above commands.

*FX15,1: Flushes the keyboard buffer.

MOVE x,y: Move graphics cursor to horizontal position x and vertical position y.

DRAW x,y: Draw a line from the current position of the graphics cursor and the point x,y.

GCOL0,X: Sets colour of graphics to logical colour X.

TIME=X: Resets the internal timer to X.

CLG: Clears the graphics screen.

PLOT 85,X,Y: Complete and fill in a triangle in the current graphics colour between the last two points visited and X,Y.

PRINT TAB(X,Y): Print at a position X characters across the screen and Y lines from the top.

RND(X) WHERE X 1: Choose a random number between 1 and X.

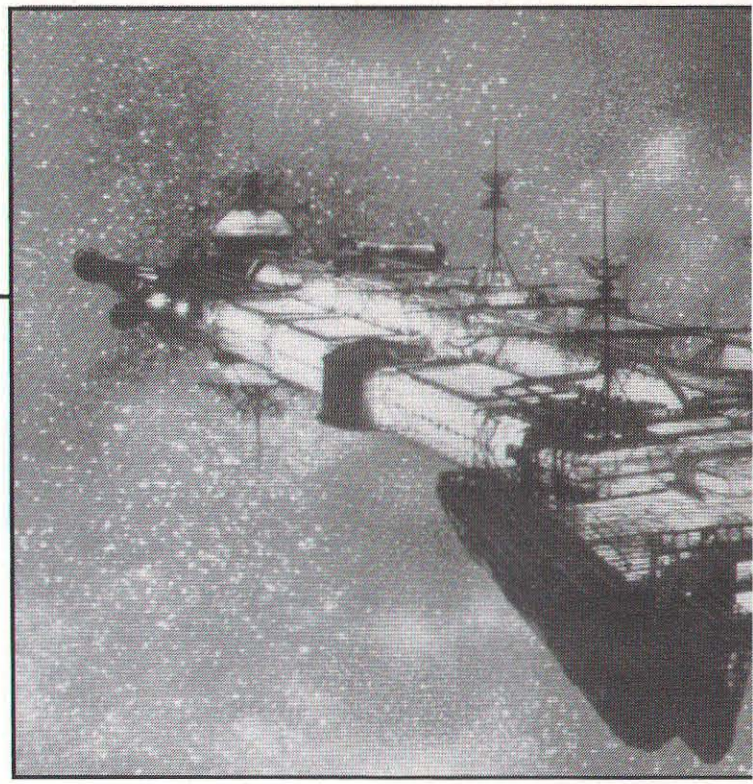
PROGRAM STRUCTURE

Lines 10 - 50
Display title and gives user option of instructions.

Lines 60 - 230
Sets all necessary variables, defines text and graphic windows, displays game format on screen, sets up the position of the first alien and resets the auto-repeat delays and time clock.

Lines 240 - 300
The main game cycle lays between these lines. The program repeats continuously through these lines, only leaving them to move the alien and fire its lasers, or to obey a players command.

CONTINUED OVER



Lines 310 - 390
If the player has used one of the cursor keys, this routine adjusts the co-ordinates of the centre of the laser-sights accordingly. The routine to draw the new sight is then run. If the player pressed the space bar, the fire-laser routine is executed. (line 370).

Lines 400 - 420
Draw laser-sights on screen

Lines 430 - 540
Display player's laser beams with accompanying sound effects, re-displays the new fuel level and check to see if the alien has been hit. The time is then updated.

Lines 550 - 590
Randomly generate the position where the alien will appear from. The scaling variables used to make the alien alter in size are reset.

Lines 600 - 740
Line 610 deletes the present alien on the screen. 620 to 690 adjusts the position of the centre of the alien, thus occasionally causing it to change direction. The scaling factors are also changed, causing the alien to be either smaller or larger than the one just preceeding it, when it is next displayed. (This creates the illusion of the alien moving away from and towards the player.)
Line 730 draws the alien on the screen: P1%/P2% being the horizontal/vertical position of the centre of the alien.

Lines 750 - 860
Draws the alien craft's laser beams on the screen, with the relevant sound effect. The value of the player's force field is decremented by three and the new energy level displayed.

Lines 870 - 1070
Simulates explosion of Alien. At the beginning of this routine, the time counter on the screen is stopped. If the alien destroyed is the fifth in the current series, the force field energy level has thirty-five units added to it. All the necessary variables are either reset or adjusted, enabling a new craft to be displayed. The screen is cleared and a new set of stars plotted. The clock is restarted and control passed back to the main loop.

Lines 1080 - 1150
This routine is only used once in every game, and draws the mountain scenario at the base of the screen. This is achieved by the joining up many different sized triangles.

Lines 1160 - 1230
Produces a hundred randomly placed stars on the screen.

Lines 1240 - 1360
Used at end of each game. The demise of the player's laser battery is simulated. After this, the length of time which the player survived for is shown, together with the longest time so far. An option to play again is given. If this is declined, the program ends. If not, the program restarts.

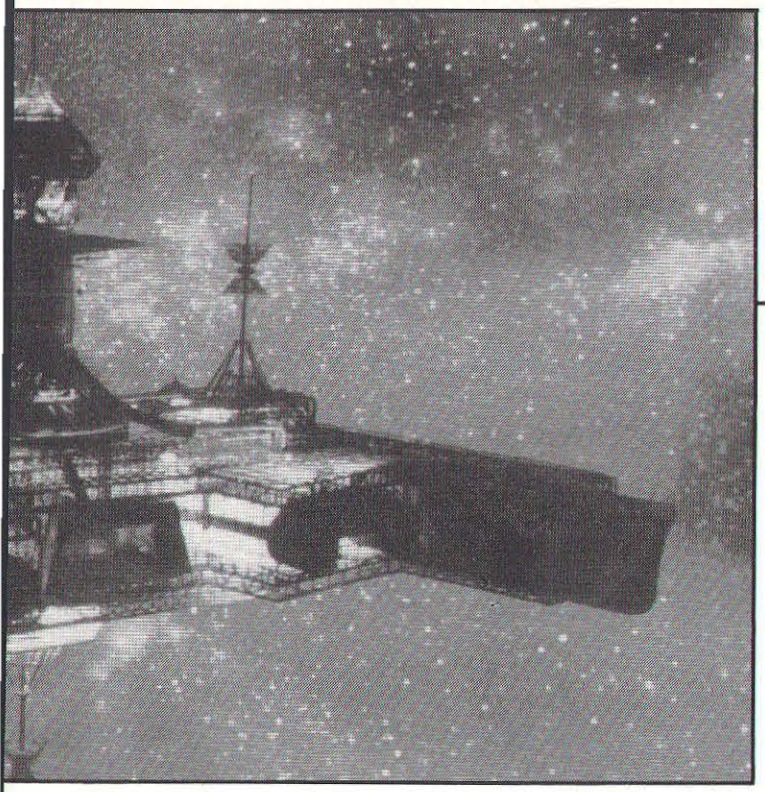
Lines 1370 - 1440
Instructions displayed.

Lines 1450 - 1470
Routine used for generating the on-screen clock. (Shown in minutes and seconds)

PROGRAM LISTING

```
   10  MODE 7
   20  FOR N=1 TO 2:PRINT TAB(11);CHR$(133);CHR$(141);"
EARTH BATTLE":NEXT
   30  PRINT TAB(10,10);"A P.J.K. PRODUCTION"
   40  PRINT TAB(3,20);"DO YOU REQUIRE INSTRUCTIONS (Y/
N)":A$=GET$
   50  IF A$="Y" THEN MODE 4:PROCINSTRUCTIONS
   60  HISCORE=0
   70  MODE 2
   80  P%=700:SH%=250:K%=0:AL%=0
   90  VDU 19,6,0,0,0,0
  100  VDU 28,0,3,19,0
  110  PROCSTARS
  120  COLOUR 130:CLS
  130  PROCMOUNTAINS
  140  VDU 24,0;260;1270;890;
  150  COLOUR 1:PRINT"FUEL";TAB(9);"SHIELD":PRINT'TAB(6
);"TIME"
  160  PRINT TAB(5,0);P%;" ":PRINT TAB(16,0);SH%;" ":PR
INT TAB(11,2);"0";" "
  170 X%=600:Y%=700
  180  PROCSA
  190  PROCALIEN
  200  PROCMOVE
  210  *FX4,1
  220  *FX11,1
  230  TIME=0
  240  A%=INKEY(0):IF A%>=136 AND A%<=139 THEN PROCMOVE

  250  IF INKEY(-99) AND P%>0 THEN PROCFIRE
  260  IF RND(7)=1 THEN PROCALIENFIRE
  270  *FX15,1
  280  PROCALIEN
  290  IF SH%<=0 THEN ZZ=TIME:GOTO 1240
  300  GOTO 240
  310  DEFPROCMOVE
  320  GCOL0,0:PROCDISPLAY
  330  IF A%=136 THEN X%=X%-80:IF X%<0 THEN X%=0:GOTO 3
80
  340  IF A%=137 THEN X%=X%+80:IF X%>1270 THEN X%=1270:
GOTO 380
  350  IF A%=138 THEN Y%=Y%-80:IF Y%<260 THEN Y%=260:GO
TO 380
  360  IF A%=139 THEN Y%=Y%+80:IF Y%>900 THEN Y%=900
  370  IF INKEY(-99) AND P%>0 THEN PROCFIRE
  380  GCOL0,2:PROCDISPLAY
  390  ENDPROC
  400  DEFPROCDISPLAY
  410  MOVE X%-15,Y%:DRAW X%+15,Y%:MOVE X%,Y%-15:DRAW X
%,Y%+15
```



```
  420  ENDPROC
  430  DEFPROCFIRE
  440  GCOL0,7
  450  MOVE 0,300:DRAW X%,Y%:DRAW 1279,300
  460  SOUND 0,-14,5,2
  470  FOR K=1 TO 20:NEXT:GCOL0,0:MOVE 0,300:DRAW X%,Y%
:DRAW 1279,300
  480  IF X%>(P1%-X1%) AND X%<(P1%+X1%) AND Y%>(P2%-Y1%
) AND Y%<(P2%+Y1%) THEN PROCALIENEXPLODE
  490  P%=P%-4
  500  PRINT TAB(5,0);P%;" "
  510  IF K%=0 THEN PROCALIEN
  520  GCOL0,7
  530  PROCTIME
  540  ENDPROC
  550  DEFPROCSA
  560  P1%=RND(1150):IF P1%<100 THEN 560
  570  P2%=RND(920):IF P2%<350 THEN 570
  580  X1%=10:X2%=5:Y1%=4:M%=20:M1%=20:J%=2:J1%=1
  590  ENDPROC
  600  DEFPROCALIEN
  610  GCOL0,0:GOSUB 730
  620  P1%=P1%+M%:IF P1%<100 THEN P1%=100:M%=20
  630  IF P1%>1100 THEN P1%=1100:M%=-M%
  640  IF RND(30)=30 THEN M%=-M%
  650  P2%=P2%+M1%:IF P2%<320 THEN P2%=320:M1%=20
  660  IF P2%>840 THEN P2%=840:M1%=-M1%
  670  X1%=X1%+J%:X2%=X2%+J1%:Y1%=Y1%+J1%
  680  IF X1%>110 THEN J%=-2:J1%=-1
  690  IF X1%<10 THEN J%=2:J1%=1
  700  GCOL0,3:GOSUB 730
  710  PROCTIME
  720  ENDPROC
  730  MOVE P1%-X1%,P2%-Y1%:DRAW P1%+X1%,P2%-Y1%:DRAW P
1%+X2%,P2%:DRAW P1%+X2%,P2%+Y1%:DRAW P1%-X2%,P2%+Y1%:DR
AW P1%-X2%,P2%:DRAW P1%-X1%,P2%-Y1%
  740  RETURN
  750  DEFPROCALIENFIRE
  760  K%=P1%:K1%=P2%
  770  SOUND 0,-10,4,10
  780  PROCMOVE
  790  GCOL0,7
  800  MOVE 350,300:DRAW K%,K1%:DRAW 800,300
  810  SH%=SH%-3:PRINT TAB(16,0);SH%;" "
  820  FOR PP=1 TO 35:NEXT:GCOL0,0:MOVE 350,300:DRAW K%
,K1%:DRAW 800,300:GCOL0,7
  830  PROCMOVE
  840  K%=0
  850  PROCTIME
  860  ENDPROC
  870  DEFPROCALIENEXPLODE
  880  AL%=AL%+1
  890  IF AL%=5 THEN SH%=SH%+35:AL%=0:PRINT TAB(16,0);S
H%;" "
  900  ZZ=TIME
  910  GCOL0,6
  920  SOUND 0,-13,6,40
  930  FOR Q%=1 TO 40
  940    MOVE P1%,P2%
  950    DRAW RND(1000),RND(1000)
  960    NEXT Q%
  970  F=6
  980  FOR B=1 TO 15
  990    FOR N=1 TO 25:VDU 19,6,F,0,0,0:NEXT
 1000    IF F=6 THEN F=0 ELSE F=6
 1010    NEXT
 1020  VDU 19,6,0,0,0,0
 1030  CLG
 1040  PROCSA:PROCSTARS
 1050  TIME=ZZ
 1060  PROCTIME:PROCMOVE
 1070  ENDPROC
 1080  DEFPROCMOUNTAINS
 1090  MOVE 1279,10:MOVE 1279,10
 1100  GCOL0,2
 1110  PP=1200
 1120  REPEAT
 1130    PP=PP-RND(50):PLOT 85,PP,RND(220)+20:PLOT 85,P
P+RND(20),10:UNTIL PP<50
 1140  PLOT 85,0,10
 1150  ENDPROC
 1160  DEFPROCSTARS
 1170  GCOL0,7
 1180  FOR N=1 TO 100
 1190    C%=RND(1000):IF C%<240 THEN 1190
 1200    C1%=RND(1200)
 1210    MOVE C1%,C%:DRAW C1%,C%
 1220    NEXT N
 1230  ENDPROC
 1240  *FX12,0
 1250  FOR N=1 TO 7
 1260    FOR K=1 TO 40:VDU19,0,0,0,0,0:NEXT
 1270    FOR L=1 TO 40:VDU19,0,7,0,0,0:NEXT
 1280    NEXT N
 1290  MODE 4
 1300  *FX12,0
 1310  PRINT"TIME GIVEN WAS : ";(ZZ DIV 6000)MOD 60;" M
INUTES ";(ZZ DIV 100)MOD 60;" SECONDS "
 1320  IF ZZ>HISCORE THEN HISCORE=ZZ
 1330  PRINT''"HIGH SCORE IS ";(HISCORE DIV 6000)MOD 60
;" MINUTES ";(HISCORE DIV 100)MOD 60;" SECONDS"
 1340  PRINT'''"Do you wish to play again (Y/N)"
 1350  A$=GET$:IF A$="Y" OR A$="N" THEN 1360 ELSE 1350
 1360  IF A$="Y" THEN 70 ELSE END
 1370  DEFPROCINSTRUCTIONS
 1380  PRINT TAB(6);"INSTRUCTIONS FOR EARTH BATTLE"
 1390  PRINT''"   You are the last line of defence for
Earth. You cannot save the planet, but  you can give th
e survivors enough time  to enable them to escape."
 1400  PRINT''"   You yourself cannot survive,but while
your shields and fuel last, you can     still destroy t
he aliens. For every fivealiens you destroy your shield
s will be partly replenished."
 1410  PRINT''"A cross is marked on the screen where
your guns are aiming at. To alter its    position, use
the cursor control keys. To fire, use the space bar. A
direct hit is sometimes not necessary in order to destr
oy an alien"
 1420  PRINT''"Good Luck!"
 1430  PRINT'''TAB(4);"PRESS ANY KEY TO START THE GAME"
:A$=GET$
 1440  ENDPROC
 1450  DEFPROCTIME
 1460  PRINT TAB(11,2);(TIME DIV 6000)MOD 60;":";(TIME
DIV 100)MOD 60;" "
 1470  ENDPROC
>
```

Down Memory Lane

The Spacetime series pours over the pages of BBC and Electron memory

In the last two issues I mostly talked about speed, so this article is given over to the problem of memory. It will cover what various bits of the BBC micro memory are used for, which ports to use in an emergency, and how to use them. The vital topic of 'relocating' programs — particularly useful for owners of disc drives — will also be dealt with. First, here is a broad-brush picture of the uses of the various pages in the BBC micro's memory.

Zero page: &00 to &FF
This is available to the 6502 microprocessor, the heart of the computer, much faster than other ports of the memory, using fewer op-code bytes. It is therefore used for all sorts of things &70 to &8F is reserved for the user.

Page 1: &100 to &1FF
This page is used by the 6502 to store numbers tempororily. It is called the 6502 stack.

Page 2: &200 to &2FF
This page is used to store important addresses, flags, and variables used by the operating system.

Page 3: &300 to &3FF
Stored here is all the information the operating system needs to keep track of the graphics and text in the current mode, plus a few other things.

Page 4: &400 to &4FF
This page and the next three are used by the BASIC interpreter chip for running BASIC programs or interacting with the user through BASIC commands. Other languages such as BCPL, Forth and so one may also use these pages. Under BASIC, page 4 is used for storing the resident integer variables A% to Z% and @%, plus pointers to any other variables in use, and to the procedures and functions.

Page 5: &500 to &5FF
This is used by BASIC for various more or less important numbers and flags.

Page 6: &600 to &6FF

This is used as temporary storage for various things like strings ands sets of parameters that the BASIC interpreter needs space for.

Page 7: &700 to &7FF
This is used by the BASIC interpreter for storing the current input line for 'crunching' it.

Page 8: &800 to &8FF
Mostly dedicated to the sound system. The current envelopes are stored at the top, from &8C0 up, and the four sound channels are controlled through the memory locations &840 to &87F.

Page 9: &900 to &9FF
This is not used unless the cassette is recording a program, you are sending data out of the RS423 port, you have defined extra envelopes, or a speech system is in operation.

Page A: &A00 to &AFF
Used even less than page 9: only when loading from cassette or receiving data through the RS423 port.

Page B: &B00 to &BFF
This area is used to store all the information programmed into the function keys 0 to 10 (or 0 to 15 if you use *FX4,2).

Page C: &C00 to &CFF
The user-defined characters numbered 224 to 255 are stored here.

Page D: &D00 to &DFF
This page is used if you system has disc drives attached or is connected to Econet, and the top half is used if you have extra ROMs fitted such as View, Wordwise, or Forth.

THE SPACE STEALERS

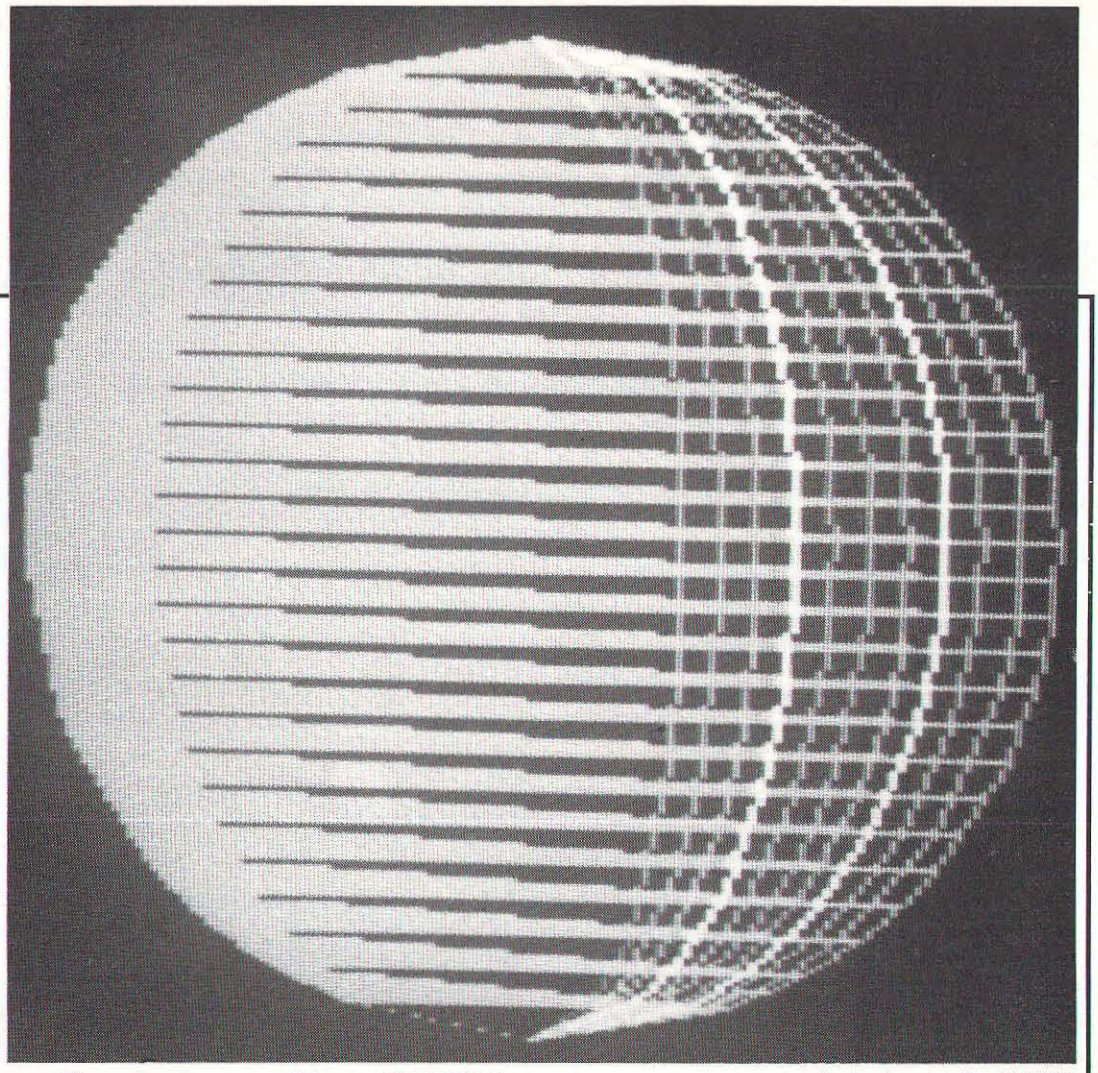
From &E00 to the bottom of screen memory is nominally all for you, the user. However, a number of things can steal space from you. Here are some of them:

- The disc system will take pages &E to &18 for loading and saving data or programs, storing its catalogue, and so on. Page will be set to &1900; some details of how to recover this memory are given below.
- Other systems such as Econet may also steal space, some of it in addition to the space the disc system takes.
- If you use a *FX20 in order to be able to define extra characters, you will lose one page of memory for every 32 characters you ask for. *FX20,1 will use up one page, while *FX20,6 will use six.

So on a disc system, operating in mode 0, under *FX20,6, page will be at &1F00 and HIMEM, which marks the top of usable memory and the beginning of the screen memory, will be set to &3000. This leaves just 4.25K bytes of free memory. (This somewhat extreme example is not entirely fanciful. It is just what would be needed to perform multilingual wordprocessing on an 80 column screen, using Roman, Greek and Arabic letters simultaneously, for instance. What is remarkable is not that such a task is difficult, but that a BBC micro with a second processor attached could do it quite easily!)

NO ROOM IN THE INN

Now let's see what can be done when you, the micro user, feel you are running out of memory. For the moment, I assume you have an ordinary tape based model B, page is at &E00 (if you are not sure what it is, type PRINT PAGE) and the dreaded NO ROOM message has just come up.



The simplest, most obvious thing to do is to move page down a bit. Save the program, type PAGE = &D00, and reload from tape. There is absolutely nothing that can go seriously wrong provided you are not connected to a disc drive or Econet, and stick with the BASIC interpreter.

Moving page even lower is possible, but becomes tricky. PAGE = &C00 is alright if you are not using user-defined characters and the program does not define any, for instance if the program is a massive adventure game in mode 7. Setting PAGE = &B00 means you cannot use the red function keys. Watch out for side effects. Redefining characters or function keys will wreck your program, and so will pressing BREAK. OLD will give the BAD PROGRAM message.

If you are prepared to put up with these problems, there is virtually nothing to stop you moving page down further, although it is not possible to load a program from tape into page &A, or to save one from page &9 onto tape, since these pages are used during the loading and saving activities. The way around the problem is to use the technique of relocation, familiar to disc users.

CHEAP REMOVALS

To get a program into page 9, it has to be loaded somewhere else and then moved to page 9 after all the tape operations are complete. Page can then be set equal to &900 and the program will run in the usual way.

There are several problems here. First, where to load the program, and how to do it. It should be loaded somewhere higher than &A00, using *LOAD rather than LOAD or CHAIN. Second, how to move the program into place at &900. This is done by relocation. All you need to know is the present location (&E00, say), where you want to move it to (&900, perhaps), and its length in bytes, which we can assume is &4FC bytes, for instance. If you are not sure of the length of a program, type PRINT TOP-PAGE while it is loaded.

The relocation now takes place like this:

```
FOR I% = 0 TO &4FC STEP 4:
I%!&900 = I%!&E00: NEXT
```

In general, given the length in bytes as LONG, and two addresses OLDLOC and NEWLOC, the program line:

```
FOR I% = 0 TO LONG STEP 4:
I%!NEWLOC = I%!OLDLOC:
NEXT
```

will relocate the program from OLDLOC to NEWLOC. This can be done from the keyboard, which is a nuisance, or from a different program called a loader, which is tricky. The above line can be part of a program, certainly, and will RUN; the question is, where is it put in memory itself?

If the program is not very long, say an 8K byte graphics utility or game to run in Mode 2, there is no big problem about where to put the loader. The answer is to use a mode that requires less screen memory, such as Mode 7, during loading, and put the loader in the spare space up at the top of memory, say at &7000. The loader for a program called DONKEY, of length &2500 bytes, might look like this:

```
10 MODE 7
20 *LOAD DONKEY E00
30 FOR I% = 0 TO &2500
STEP 4
40 I%?&900 = I%?&E00:
NEXT
50 PAGE = &900:RUN
```

Clearly this program itself cannot be in any of the pages from &9 to &33 which are used to load or relocate DONKEY, it will almost certainly be somewhere higher in memory. Set page to &7000 in Mode 7 before loading and running it. The program DONKEY would probably have to reset HIMEM to a sensible value before changing to Mode 2 or whatever, and it is also possible that the variable TOP would be set wrong. One way round this is to program a function key with the words 'OLD' and 'RUN', and then instruct the program user press the key. This is no good, however, if your program is now occupying page &B! If you are not particularly concerned about professional polish, line 50 above could simply be replaced by:

```
50 PRINT"Type PAGE =
&900:OLD:RUN": END
```

An aside on speed. If you want a fast relocator for BASIC programs only, try this:

```
I% = OLDLOC:J% =
NEWLOC:
REPEAT:$J% = I%:I% + L-
EN$I% + 1:J% = J% + LEN$J%
+ 1:
UNTIL?I% = &FF:7J% = &FF
```

THE DISC DANCE

This brings us to the perennial problem of transfering programs from tape to disc. As more and more BBC micro users acquire disc drives, interest in how to do this becomes more widespread, but unless you understand the simple principles you can be led a merry dance by the disc operating system.

Once the micro is fitted with the DOS, page will be set to &1900 when the machine is switched on, rather than to &E00. You load your programs from tape by using *TAPE, switch back to disc by *DISC, and save the program. This may well work out satisfactorily if the program is

CONTINUED OVER

not too long, buy many programs will not RUN when LOADED or CHAINED from disc subsequently. Basically, this is because they are too long and need all of the space down to &E00.

In many cases relocation is not even necessary. To LOAD or CHAIN a program the disc operating system does not use all of the space it steals, from page &E to page &19, but only pages &E, &F, &10 and &11. The first thing to try, therefore, is switching to PAGE=&1200 and running the program there.

If this fails to work, some relocation will be needed. Unless the program is extremely long, it should be possible to load it into memory at &1900 or &1200 and relocate it down to &E00 (or below). If it is a machine code program, you will need to know its execution address, and instead of RUNning it, CALL the execution address. To find out the execution address, use *OPT1,2 before LOADing the program, and after it has LOADED the computer will give three addresses, of which the third is the execution address.

LONG PROGRAMS

One type of program that will not yield in an obvious way to these methods is the program that apparently fills the whole of memory available in Mode 7. These programs (usually adventure games or similar text-based programs) can in fact be loaded, though only by tieing the computer into knots.

Consider the toughest problem: an adventure that occupies &E00 to &7BFF and works in Mode 7, where the screen memory runs from &7C00 to &7FFF. The program loads straightforwardly from tape: but can it be loaded from disc?

The answer is yes — just. The program should be LOADed from tape, and the bottom kilobyte (&E00 to &&11FF) relocated down to occupy &900 to &CFF. This can then be saved to disc using "SAVE, as one part of the program. The top part, from &1200 upwards, should then also be SAVED to disc using a slightly different name.

It should now be possible to LOAD the program by reversing the process. The top part is LOADed first, then the bottom kilobyte at &900, and this is relocated back up to &E00 after the LOADing is finished. The only problem is, where can the loader program itself be put?

THE FINAL SQUEEZE

Where else is there in memory? There is page &D, but this is used by the DOS for its non-maskable interrupt routines. There is the top part of page 8, which is normally occupied by envelopes but could be borrowed for a machine code loader. (The bottom part of page 8 cannot be used, since its contents are constantly being changed by the operating system's sound routines under the 100Hz interrupts from timer one. These can be stopped using *FX233,233, but that is a desperate measure indeed, since it stops almost everything, even the clock!)

There are a few bytes in zero page, &70 to &8F, that are reserved for the user. These are very useful to machine code programmers, but unless you are prepared to write your own machine code program loader, they are not a lot of use since you cannot set page equal to &0070. A program loader is not difficult in machine code, and if you *are* prepared to write one, of course, you have the whole of pages 4, 5, 6 and 7 to play with while BASIC is out of action.

In fact there are a couple of other solutions to this problem. One is to put the loader at &C00 and LOAD the 1 kilobyte that has to go at &E00 first to &FC00, then relocate it down. That's right, at &FC00, into the screen memory. Well why not? You have to be careful not to write anything onto the screen while the vital program is occupying it, and that no scrolling is allowed — but it can be made to work.

The second solution is to put the loader at &600. This really is cheating, since page 6 is BASIC workspace. The incredible truth is that simple programs placed here will RUN successfully, provided they do not try to write any strings or call machine code subroutines. A simple BASIC loader with relocation is a good example.

As usual, a problem to finish. Can anyone think of a way to load a complete machine code program occupying all of &400 to &7C00, from tape or disc.

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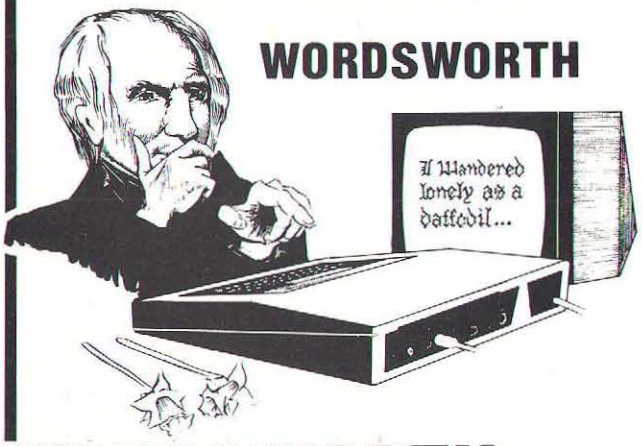

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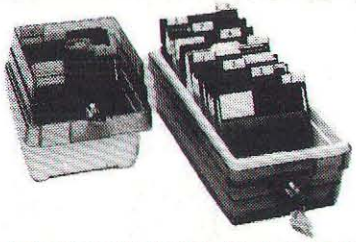

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Puss In Boots

S. W. Lucas

The pantomime season has now drawn to an end but why not extend the fun into Spring with this adventure loosely based on the well-known tale.

Once upon a time there was a miller who had three sons. He was so poor that when he died he left nothing but his mill, his donkey and his cat. The mill, of course, was left to the eldest son, the donkey to the middle son and all that was left for the youngest son was his cat! Imagine the astonishment felt by the youngest son when he heard the cat speak to him. 'Do not worry, dear master' said the cat, 'get me a pair of boots and a bag and I shall solve all your problems. You *WILL* marry the most beautiful princess in the whole land!'.

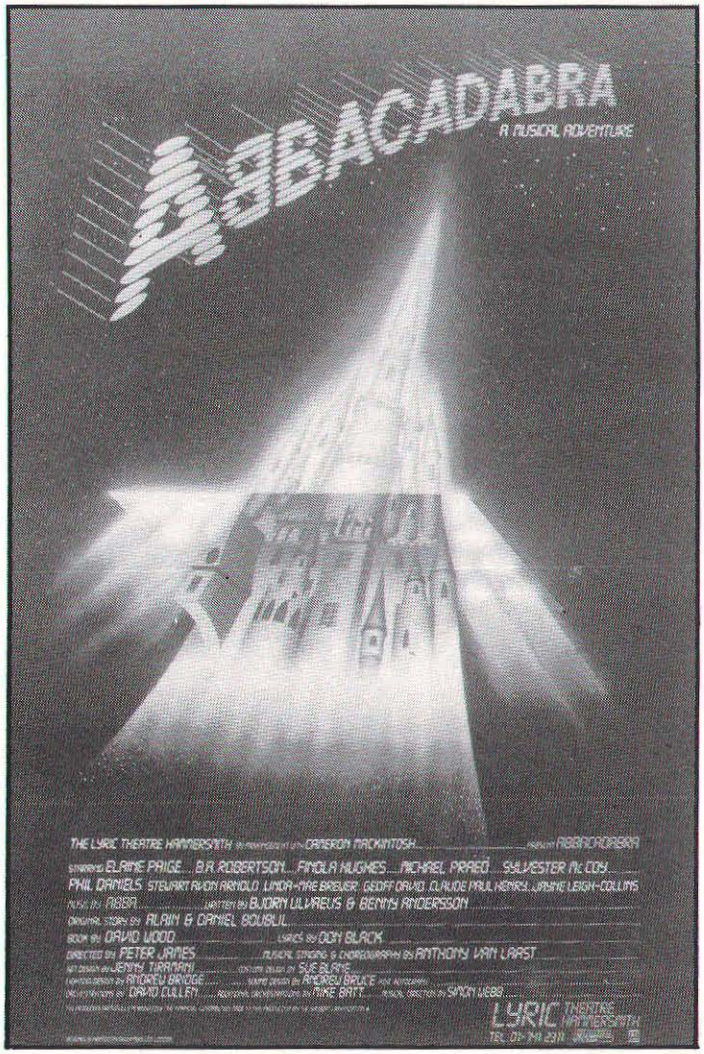
In this game you will play the part of the miller's youngest son and the computer will play the part of the cat. You must give the computer instructions in the form of two word sentences such as GET FOOD, KILL RAT etc. The object of the game is to marry the princess. Along your journey you will come across many problems to solve. If you get stuck you can ask the computer for HELP, and there again you could read the book.

PROGRAM DETAILS

The program loads in two parts. Part 1 is saved under the file name PUSS and part 2 BOOTS. Part 1 is used to provide instructions, turn off the cursor and disable the escape key.

As with all adventures, too much help can spoil the fun in playing the game. In order to prevent the program from being listed: type ?(PAGE+7)=&15 and press RETURN after you are sure that the program works O.K. Then SAVE a copy of the program before running it. This will POKE a screen disable command into the first REM statement and this will stop it being listed.

The program is written in MODE7. There are 51 locations to visit.



PROGRAM EXPLANATION

A. Part 1

Lines 70 and 80 are used to disable escape and to set the function key 10 to prevent the user breaking out of the program. I would strongly recommend that you do not add these lines until you have fully debugged the program. SAVE the program BEFORE you run it.

Line 140 calls the draw procedure

Line 290 is used to set PAGE to &1100 for disc use and to CHAIN part 2

B. Part 2

Lines 70-80 disable escape and set break key – see comment above

Lines 110-140 set all variables

Line 180 calls PROCdata which reads the data into the arrays.

The main program control is the REPEAT UNTIL W% = 10 loop from lines 190-890

W% holds the score and when the score is ten, line 900 will call PROCwin

Lines 440-870 test for the words recognised and call the appropriate procedure. I have tried to use procedure names which indicate the operation of the procedure e.g. PROChelp.

MAJOR VARIABLES USED

P% Hold current location
S% (X,Y) holds the MAP
Q$(X) holds the description of the locations
W% holds the score
C$ is used to check the first three letters of the instruction entered
Z$ holds the instruction entered
L$ holds the second word of the instruction
B$ holds the first two letters of the instruction
G$(x) holds items to be found
N$(X) holds words understood
other variables are used as flags to test whether certain events have taken place.

HELP

DO NOT READ THIS SECTION UNLESS YOU ARE REALLY STUCK

1. If you get stuck try HELP
2. If you have forgotten the ring try PRAY
3. In the shop have you got any money?
4. Can't catch the rabbit – have you got the lettuce and the bag to catch it in?
5. Can't get past the dogs in the King's chamber? – why not give the King the partridge
6. Can't get past the river? Try hiding the clothes!
7. Don't touch rusty knives!
8. Locked doors need keys!
9. Ogres can turn into anything just ask them! (I believe mice are easily caught by cats!)
10. Why not entertain the King!
11. You can always WAIT around for a coach to stop.

PROGRAM LISTING 1

```
  80 *FX229,1
  90REM ABOVE LINE WORKS WITH O.S. 1.2  TO MAKE ESCAPE
 KEY GENERATE ITS ASCII CHARACTER!
 100 MODE7
 110 REM ** TURN OFF CURSOR **
 120VDU23;8202;0;0;0
 130PRINTTAB(0,0);
 140PROCdraw
 150FORX=5TO6
 160PRINTTAB(0,X)CHR$141;CHR$157;CHR$136;CHR$(127+X);S
PC(9);"PUSS in BOOTS"
 170NEXT
 180PRINTTAB(10,10);CHR$131;"An adventure game "
 190PRINTTAB(17,12);CHR$129"By"
 200PRINTTAB(13,14);CHR$130"S.W. Lucas"
 210PRINTTAB(0,20);
 220PROCdraw
 230PRINTTAB(0,17);
 240FORA=1TO50
 250READX
 260SOUND1,-10,X,2
 270NEXT
 280PROCinstructions
 290PAGE=&1100:CHAIN"BOOTS"
 300 REM ### THE CHANGE OF PAGE IN THE ABOVE LINE IS N
EEDED ONLY IF YOU INTEND TO USE THE PROGRAM FROM DISC
 310END
 320DEFPROCdraw
 330VDU145;:FOR1in=1TO36STEP2:VDU183,245:NEXT:VDU183,1
81,159
 340VDU145;:FOR1in=1TO36STEP2:VDU245,183:NEXT:VDU245,1
81,159
 350ENDPROC
 360DATA105,105,117,121,129,137,105
 370DATA57,57,69,73,81,89,57,105,105,117,121,129,137,1
05,57,57,69,73,81,89,57,105,105,117,121,129,137,105,57,
57,69,73,81,89,57,105,105,117,121,129,137,105,57,57,69,
73,81,89,57,105,105,117,121,129
 380DEFPROCinstructions
 390CLS:PROCdraw
 400PRINTTAB(0,5);"Once upon a time there was a miller
 who had three sons. He was so poor that whenhe died he
 left nothing but his mill,   his donkey and his cat."
 410PRINT"The mill, of course, had to be left to  his
eldest son. The donkey to his secondand all that was le
ft for the youngest  son was his fathers cat."
 420PRINT"'Do not worry, dear master' said the catgive
 me a pair of boots and a bag and I shall solve all you
r problems."
 430PRINTTAB(5,21);CHR$131;CHR$136;"Press <SPACE BAR>
to continue."
 440PROCdraw
 450PRINTTAB(0,20)
 460REM NOW FLUSH INTERNAL BUFFERS
 470 *FX15,0
 480REPEAT
 490A$=GET$
 500UNTIL A$=" "
 510CLS:PROCdraw
 520PRINT"My name is PUSS and you are the youngestson
of the miller."
 530PRINT'CHR$131;"You must help me to help you!"'
 540PRINT''CHR$134;"This game follows the story of the
"
 550PRINTCHR$134"fairy story very closely and you are"
 560PRINTCHR$134"advised to read it if you get stuck."
 570PRINTCHR$130"You must give me instructions in the
"'CHR$130"form of 2 word sentences such as"'CHR$130"GET
 LAMP, RUN SOUTH, EAT FOOD etc."
 580PROCdraw
 590 ENDPROC
>
```

MAIN PROGRAM LISTING

```
  10 REM ** PART 2 OF PUSS IN BOOTS **
  20 REM ** AN ADVENTURE GAME FOR THE BBC MICRO **
  90 REM** TO PREVENT LISTING THEN ADD ?(PAGE+7)=&15 W
HICH WILL POKE THE CLEAR SCREN CHARACTER INTO THE FIRST
 REM STATEMENT AND PREVENT THE PLAYER FROM LISTING THE
PROGRAM
 100 REM** UNLESS THEY ARE DETERMINED TO CRACK THE SYS
TEM!
 110A%=0:B%=0:C%=0:D%=0:E%=0:F%=0:G%=0:H%=0:I%=0:J%=0
 120K%=0:L%=0:M%=0:N%=0:O%=0:P%=1:Q%=0:R%=0:S%=0:T%=0:
U%=0:V%=0:W%=0:X%=0:Y%=0:Z%=0
 130AQ$=""
 140P%=1:G%=0:SA=0:SB=0:SC=0:SD=0:SE=0:SS=0:AB=0:AA=0:
AC=0:AD=0:AE=0:AF=0:AG=0:AH=0
 150CLS
 160FORX=1TO2:PRINTTAB(0,10+X);CHR$141;CHR$136;CHR$(13
0+X+1);"<C> 1983      S.W. Lucas":NEXT
 170DIMS%(103,4),X$(35),N%(33),Q$(103),G$(30),V$(4),B%
(30,1),N$(33)
 180RESTORE:PROCdata:CLS
 190REPEAT
 200IFP%=50ANDU%=1THENW%=W%+1:P%=51:K=1
 210IFP%=50ANDU%<>1THENPRINTCHR$129"Whoops!":CHR$131;"
I have forgotten the ring!":K=1
 220IFP%=14ANDAE=1THENPROCgift
 230PROCscore
 240PRINTCHR$131;"I am :-"'Q$(P%):A$="":IFS%(P%,1)>0TH
ENA$="North"
 250IFS%(P%,2)>0ANDLEN(A$)>0THENA$=A$+",South"ELSEIFS%
(P%,2)>0THENA$="South"
 260IFS%(P%,3)>0ANDLEN(A$)>0THENA$=A$+",East"ELSEIFS%(
P%,3)>0THENA$="East"
 270IFS%(P%,4)>0ANDLEN(A$)>0THENA$=A$+",West"ELSEIFS%(
P%,4)>0THENA$="West"
 280IFS%(P%,1)=0 ANDS%(P%,2)=0ANDS%(P%,3)=0ANDS%(P%,4)
=0THENA$=""
 290IFP%=45THENA$="nowhere as the King won't   let me"
 300IFP%=2ORP%=4THENA$=A$+",In"
 310IFP%=8THENA$="UP, OUT" ELSE IFP%=9THENA$="DOWN"
 320IFP%=18THENA$=A$+",Up"ELSEIFP%=22THENA$=A$+",Down"
 330IFP%=46ORP%=51THENA$="nowhere!"
 340IFG%>100THENPRINTCHR$(134);X$(17)
 350PRINT''CHR$130;"I can go :- ";:PRINTA$'''
 360E=0:FORT%=1TO20:PP%=0:IFB%(T%,1)=P%THENPP%=1
 370IFPP%=1THEN390
 380NEXT:GOTO410
 390IFE=0THENPRINTCHR$(134);"That looks like :-"
 400PRINTG$(T%):E=E+1:GOTO380
 410PRINT'CHR$133"What do I do now";:INPUTZ$:B$=LEFT$(
Z$,2):C$=LEFT$(Z$,3)
 420CLS:PRINTCHR$134"Hang on a second!":SOUND0,-15,100
,5
 430K=0
 440IFC$="ASK"ORC$="SAY"ORC$="TAL"THENPROCmagic
 450IFC$="LOO"THENK=1
 460IFC$="SCO"THENK=1:PROCscore ELSEIFC$="EAT"THENPRIN
T"I'm absolutely full and I couldn't eat any more!":K=1

 470IFC$="RUB"THENPRINT"Don't be silly now!!!!":K=1
 480IFC$="DRI"THENPRINT"what do you think I am, an alc
oholic?":K=1
 490IFC$="HEL"THENPROChelp
 500IFC$="RUN"THENPROCrun
 510IFC$="SAY"ORC$="SPE"THENPRINTCHR$129"O.K. I talk -
- but nobody listens!":K=1
 520IFC$="WEA"ORC$="TRY"THENPROCwear
 530IFC$="PRA"ORC$="CRY"THENK=1:PROCpray
 540IF(B$="N"ORLEFT$(Z$,4)="GO N")ANDS%(P%,1)<>0THENP%
=S%(P%,1):K=1
 550IF(B$="S"ORLEFT$(Z$,4)="GO S")ANDS%(P%,2)<>0THENP%
=S%(P%,2):K=1
```

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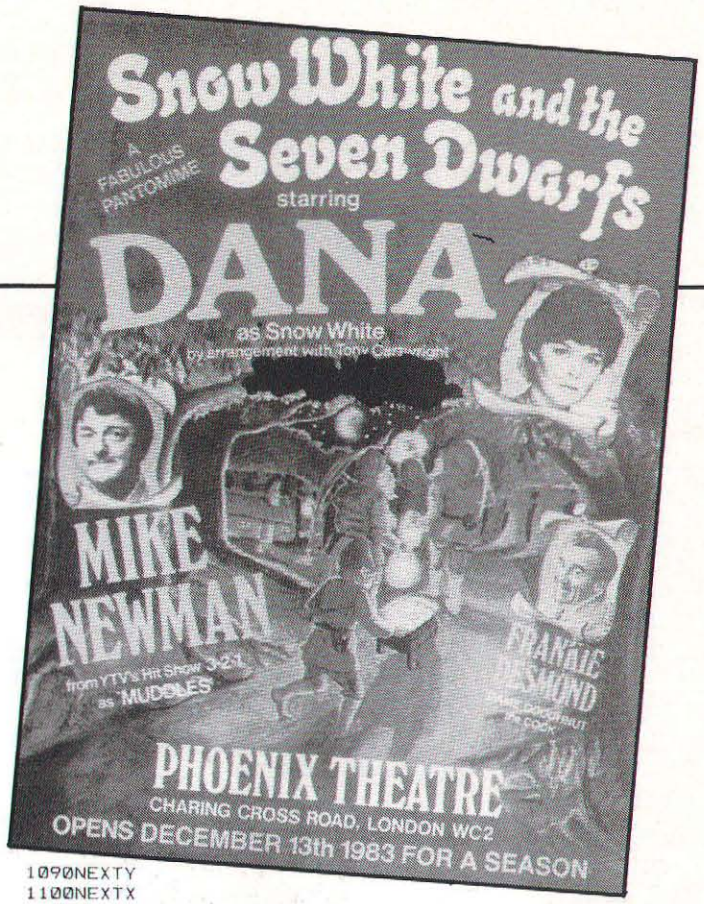
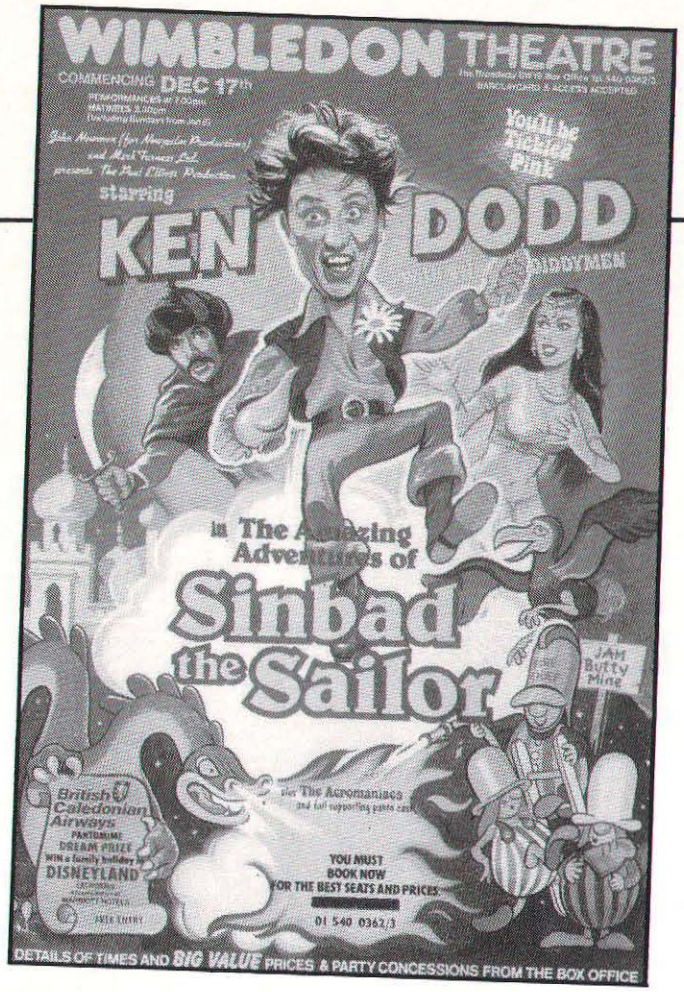


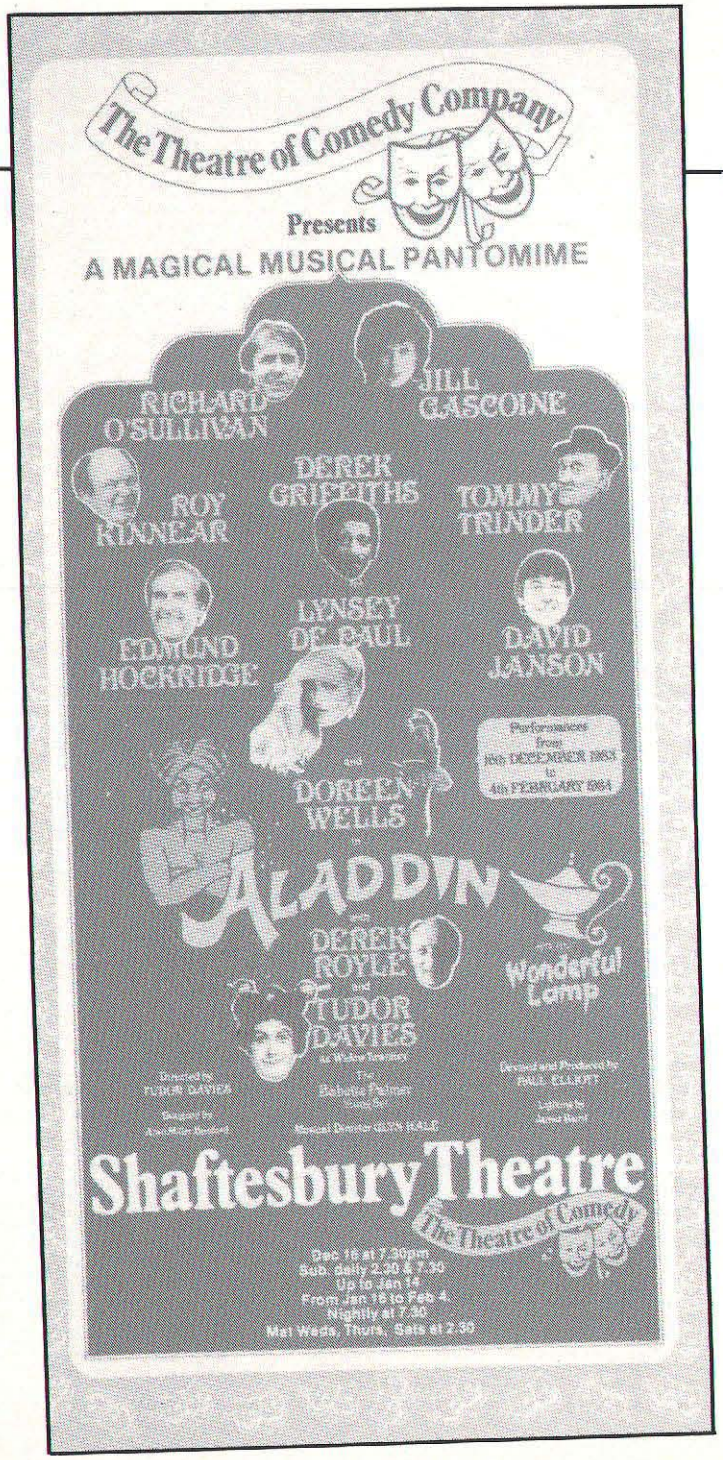

```
560IF(B$="E"ORLEFT$(Z$,4)="GO E")ANDS%(P%,3)<>0THENP%
=S%(P%,3):K=1
570IF(B$="W"ORLEFT$(Z$,4)="GO W")ANDS%(P%,4)<>0THENP%
=S%(P%,4):K=1
580IFB$="RE"THENPRINT"I'm sorry, I can't see anything
 here to read!":K=1
590IF(B$="S"ORB$="N"ORB$="E"ORB$="W")ANDK=0THENPRINT"
I can't go that way!":K=1
600IFC$="PHO"THENPRINT"I'm not E.T. you know. I do ne
ed a phone":K=1
610IFC$="ENT"ORC$="DIN"ORC$="FEE"ORC$="LUN"ORC$="BAN"
THENPROCentertain
620IFB$="FU"ORB$="PI"ORB$="BU"THENPROCswear"
630IFC$="HID"THENPROChide
640IFB$="BU"THENPRINTCHR$129"What do you think I am -
- made of money?":K=1
650IFC$="INV"THEN PROCinventory
660IFC$="ROW"ORC$="SAI"ORZ$="GO BOAT"THENPRINTCHR$129
"Just how do you intend me to that here?":K=1
670IFB$="UP"ORC$="CLI"ORZ$="GO UP"THEN PROCup
680IFC$="DOW"ORZ$="GO DOWN"THEN PROCdown
690IFC$="OUT"ORZ$="GO OUT"THEN PROCout
700IF(B$="IN"ORZ$="GO IN")ANDK=0THENPROCin
710IFC$="PUS"THENPROCpush
720IFC$="WAS"THENPRINTCHR$129"I'm not a servant you k
now!":K=1
730IFC$="DAN"THENPRINTCHR$129;"O.K. nobody seems to a
ppreciate my      dancing though!":K=1
740IFZ$="GO RIDE"ORC$="RID"THENPRINT"not yet!!!":K=1
750IFC$="WAI"THENPROCwait
760IFC$="JUM"ORC$="DIV"THENPROCjump
770IFB$="GE"ORB$="TA"ORB$="GR"THEN PROCget
780IFC$="DRO"ORC$="LEA"ORC$="PUT"THEN PROCdrop
790IFC$="SWE"THENPRINTCHR$129;"Don't be silly!":K=1
800IFC$="OPE"THENPRINT"Not yet!":K=1
810IF C$="UNL"THEN PROCunlock
820IF C$="KIS" THEN PROCkiss
830IFC$="GIV"THEN PROCdrop
840IFC$="EXA"THENPRINT"I can't see anything special!!
!":K=1
850IFC$="SEA"THENPROCsearch
860IFC$="KIL"ORC$="SHO"ORC$="ATT"ORC$="DES" THEN PROC
kill
870IFC$="SWI"THENPRINT"If you give me the direction,
I'll swim if necessary!":K=1
880IFK<1THENPRINTCHR$135"I'm  afraid I don't understa
nd that!!!"
890UNTILW%=10
900PROCwin
910END
920DEF PROCdata
930FORH%=1TO51
940READQ$(H%)
950FORD%=1TO4
960READS%(H%,D%)
970NEXTD%,H%
980FORH%=1TO16:READG$(H%),B%(H%,1):NEXT:FORH%=1TO22:R
EADN$(H%),N%(H%):NEXT
990ENDPROC
1000DEF PROCwin
1010CLS
1020FORX=1TO2
1030 PRINTTAB(0,X+14);CHR$(141);CHR$(X+130);"W E L L
 D O N E !!"
1040NEXT
1050PRINT'''CHR$(131);"You have solved this adventure
!"
1060PRINT''CHR$129"You have helped the miller's son t
o"'CHR$131"MARRY"CHR$129" the beautiful princess"'CHR$1
30"and you live happily ever after in the"'CHR$131"pala
ce with the Prince and Princess!"
1070FORX=5 TO 1 STEP -1:FORY=220TO1 STEP-2
1080SOUND1,-10,Y,0
1090NEXTY
1100NEXTX
1110CLS:PRINTTAB(0,10)CHR$131"Would you like another g
ame <Y>es "'CHR$131"or <N>o"
1120REPEAT S$=GET$
1130UNTILS$="Y"ORS$="N"ORS$="y"ORS$="n"
1140IFS$="Y"ORS$="y"THENRUN
1150END
1160DEF PROCup
1170K=1:IFP%=8THENPRINT"O.K. I climb the steps":P%=9:E
NDPROC
11801FP%=18THENPRINT"O.K. I climb the stairs":P%=22:EN
DPROC
1190PRINT"I can't do that here !!!":K=1:ENDPROC
1200DEF PROCdown
1210K=1
1220IFP%=9THENPRINTCHR$130"I climb down the steps":P%=
8:ENDPROC
1230IFP%=22THENPRINT"O.K.":P%=18:ENDPROC
1240PRINT"I'm can't do that just at the moment!":K=1:E
NDPROC
1250DEF PROCout
1260K=1
1270IFP%=21THENP%=4:PRINT"O.K.":ENDPROC
1280IFP%=8THENP%=2:PRINT"O.K.":ENDPROC
1290PRINT"I'm sorry I'm not able to do that here!":K=1
:ENDPROC
1300DEFPROCin
1310K=1
1320IFP%=4THENP%=21:PRINT"I go into the shop":ENDPROC
1330IFP%=2THENP%=8:PRINT"O.K.":ENDPROC
1340DATAouside an old rundown mill,2,5,7,3
1350DATAoutside an old barn,0,1,0,0,on an overgrown fo
otpath.,0,4,1,0,outside the village shop.,3,0,0,0,insid
e the old mill. It is full of       cobwebs,1,6,0,0
1360DATAin the living quarters. It is deserted,5,0,10,
0,in an overgrown garden,0,0,11,1
1370DATAinside the old barn. A ladder leads up  to the
 hayloft.,0,0,0,0,inside the hayloft. The ladder leads
   down from here.,0,0,0,0
1380DATAin a bedroom which is full of dust!,0,0,0,6,on
 a narrow footpath. It is too muddy togo East without w
earing BOOTS!,0,0,0,7
1390DATAby a rabbit hole,0,13,0,11
1400DATAoutide an old castle.The guards will notlet me
 pass South into the castle!,12,0,0,0,in a rundown cour
tyard. The guard will  not let me go North!,0,15,0,0,at
 the entrance to the King's chamber!,14,18,16,19
```

```
1410DATAat the northern end of the King's        chambe
rs.,0,17,0,15,in the King's chamber. There is a        p
assage leading East from here but two  large dogs block
 the way. The King is   here!,16,0,0,0
1420DATAat the bottom of some steps.,15,0,0,0,on a foo
tpath leading into the coutry.,0,20,15,0,on a bracken c
overed hillside. There arepheasants to be found here,19
,0,0,0
1430DATAinside a small village shop,4,0,0,0,at the top
 of some steps,0,23,0,0,in a long passage,22,26,24,27,i
n a narrow passage.,0,0,25,23,inside a small dusty room
. Everything iscovered with sheets.,0,0,0,24
1440DATAon the battlements. I can see fields in the di
stance.,23,0,0,0,in a passage,0,28,23,29,in an empty ch
amber.,27,0,0,0,in a large room.,0,0,27,0,in the royal
kitchens,0,0,31,17
1450DATAin a backyard (by the royal dustbins!),0,32,0,
30,on a footpath,31,33,0,0,by a locked gate.,32,0,0,0,b
y the river banks.,33,35,0,0,on the banks of the river.
 The Miller's son is swimming here.,35,36,0,0,by some s
hrubs,35,0,0,0
1460DATAin a very large meadow,37,37,37,37,on  footpat
h outside a cottage,0,39,0,0,inside the doorway of the
Ogre's cottageThe EVIL OGRE is here!,38,0,0,0,in a larg
e kitchen full of food,39,0,0,41,in a passage,42,0,40,4
3
1470DATAin a large living room,0,41,0,0,at the entranc
e to the house,0,0,41,44,by the open door to the dead O
gre's      house. The King is here in his carriage with
the Miller's son and the beautiful princess!,0,0,43,0
1480DATAseated in the banquet hall. With the    King;
the Miller's son and the Princess.,0,0,0,0,riding in th
e Royal carriage with the   King; the Miller's son and
the beautiful princess,0,0,0,0,in a stationary carriage
,0,0,48,0
1490DATAoutside the village church.,49,0,0,47,walking
down the aisle . the Wedding     march is playing. I hop
e I remembered    the ring,0,48,0,50,at the altar. The p
rincess; the King     and the Miller's son are here,0,0,
49,0
1500DATAat the marriage,0,0,0,0
1510DEF PROCget
1520PROCcheck
1530IFL%<>1THENENDPROC
1540E%=0
1550FORH%=1TO16:IFB%(H%,1)=P%ANDB%(N%(R),1)=P%THENE%=1
1560NEXT
1570IFE%=0THENPRINT"I can't see it here!":K=1:ENDPROC
1580IFR=1ORR=2THENPRINTCHR$129"Do you have to be stupi
d!":ENDPROC
1590IFR=11THENX$(1)="      I cut myself to death!":PROC
lose
1600IFR=12THENPRINTCHR$129"NOT BLOOMING LIKELY!":K=1:E
NDPROC
1610IF(R=18ORR=19)THENU%=1
1620IFR=5THENAA=1
1630IFR=6ORR=7THENAC=1
1640IFR=8THENAD=1
1650IFR=8ANDSA=0THENW%=W%+1:SA=1
1660IFR=9THENPROCrabbit:IFAE<>1THENENDPROC
1670IFR=10ANDAD<>1THENPRINTCHR$129"I need a"CHR$131"BA
G"CHR$129"to catch it in!":ENDPROC ELSEIFR=10THENAF=1
1680IFR=22THENAG=1
1690IFR=14THENPRINTCHR$131"I'd need a spade to do that
!":ENDPROC
1700IFR=13THENAH=1
1710IFR=15ORR=16THENPRINT"DON'T BE A DUM.DUM!":K=1:END
PROC
1720IFP%=21AND(R=3ORR=4)ANDAA<>1THENPRINTCHR$131"The a
ssistant will not let me!":K=1:ENDPROC
1730IFR=3ORR=4THENAB=1
1740E%=0:FORD%=1TO3:IFV$(D%)="" THENV$(D%)=G$(N%(R)):E
%=1:D%=5
1750NEXT
1760IFE%=0THENPRINT"I'm sorry I can't carry any more!!
!":K=1:ENDPROC
1770B%(N%(R),1)=0:K=1:ENDPROC
1780DEF PROCcheck
1790L$="":FORH%=1 TO LEN(Z$)
1800IF MID$(Z$,H%,1)=" "THENL$=RIGHT$(Z$,(LEN(Z$)-H%))
:H%=H%+40
1810NEXT
1820R=0:L%=0:IFLEN(L$)<2THENENDPROC
1830FORH%=1TO27:IF LEFT$(N$(H%),LEN(L$))=L$ THENL%=1:R
=H%
1840NEXT
1850ENDPROC
1860DEF PROCdrop
1870PROCcheck
1880IFL%<>1THENPRINT"I can't see a ";L$:K=1:ENDPROC
1890E%=0
1900FORD%=1 TO 3
1910IFV$(D%)=G$(N%(R)) THEN V$(D%)="":E%=1
1920NEXT
1930IFE%<>1 THENPRINT"I haven't got it!!!":K=1:ENDPROC
1940B%(N%(R),1)=P%
1950CLS
1960IFR=5THENAA=0
1970IF(R=18ORR=19)THENU%=0
1980IFR=3ORR=4THENAB=0
1990IFR=6ORR=7THENAC=0
2000IFR=8THENAD=0
2010IFP%=17ANDR=10ANDSB=0THENPROCgift2
2020IFAF=1ANDR=10THENAF=0
2030IFR=22THENAG=0
2040IFR=13THENAH=0
2050K=1:ENDPROC
2060DEF PROCinventory
2070PRINTCHR$(129);"I have :-"
2080PRINTA0$
2090F%=0
2100FORH%=1 TO3
2110IFV$(H%)<>""THENPRINTV$(H%):F%=1
2120NEXT
2130IFF%=0THENPRINT"not a sausage!!!"
2140PRINT
2150K=1:ENDPROC
2160DEF PROCkiss
2170K=1:PRINTCHR$129"UGHH!!! Cat's are not prone to ki
ssing "CHR$129"humans!!":ENDPROC
2180DEF PROCgive
2190K=1:PRINTCHR$130"There is nothing I'd  like to giv
e!":ENDPROC
2200DEF PROCkill
2210IFP%<>103 THENPRINT"NOT HERE AND NOW!!!":K=1:ENDPR
OC
2220DEF PROClose
2230CLS
2240SOUND0,-15,100,10
2250FORT%=1TO 2
2260PRINTTAB(0,T%+15);CHR$(137);CHR$(141);CHR$(T%+128)
;"T H A T ' S  D O N E   I T  !!"
2270NEXT
2280PRINTX$(1)
2290PRINT''''CHR$(134);"The KING is very SAD to lose
my life!"
2300SOUND0,-15,100,10
2310PRINT'''CHR$(133);"Do you want another game";CHR$(
131);"<Y>es or <N>o";
2320REPEAT
2330A$=GET$
2340UNTILA$="Y"ORA$="N"
2350IFA$="Y"THEN RUN
2360END
2370CLS
2380PRINTTAB(0,15);CHR$(131);"Thank you for playing th
is game !"''''"Goodbye!!"
2390DEFPROCpray
```

CONTINUED OVER




```
2400K=1
2410IFP%<28THENPRINTCHR$129"nothing happens!":ENDPROC
2420IFA%<>0THENPRINT"I CAN ONLY GET TRANSPORTED TWICE"
2430IFA%>2THENENDPROC
2440SOUND1,-15,90,10
2450FORH=255TO1STEP-3:SOUND1,-10,H,1:NEXT
2460IFP%=28ANDA%<>2THENA%=A%+1:P%=49:PRINT"WOW I HAVE
BEEN TRANSPORTED AGAIN!":ENDPROC
2470P%=28
2480IFA%<2THENPRINTCHR$129"WOW"CHR$131"I have been tra
nsported"'CHR$131"somewhere!":S%(28,1)=0:0$(28)="In an
empty chamber. The door North is  locked!"
2490A%=A%+1
2500ENDPROC
2510DEFPROCsearch
2520K=1:PRINTCHR$129"Try as I might, I can't find anyt
hing!"
2530ENDPROC
2540DEFPROCscore
2550PRINTCHR$129"You have scored "CHR$131;W%;CHR$129"o
ut of 10"
2560ENDPROC
2570DEFPROChelp
2580K=1
2590IFP%=21THENPRINT"The shop assistant won't give it
away!":ENDPROC
2600IFP%=39THENPRINT"WHY NOT"CHR$129"ask the OGRE if h
e can"'CHR$131"turn into something!":ENDPROC
2610IFP%=37THENPRINTCHR$129"The meadow is so large tha
t I will need"CHR$129"to RUN if I want to get anywhere!
":ENDPROC
2620IFP%=12THENPRINTCHR$129"I do believe that rabbits
like lettuce":ENDPROC
2630IFP%=40RP%=2THENPRINTCHR$131"Why not go in!":ENDPR
OC
2640IFP%=21THENPRINT"Why not go OUT!":ENDPROC
2650IFP%=90RP%=22THENPRINT"I'd go DOWN!":ENDPROC
2660IFP%=80RP%=18THENPRINT"Why not go UP!":ENDPROC
2670IFP%=46THENPRINT"There's nothing much to do here e
xcept  WAIT!":ENDPROC
2680IFP%=14THENPRINT"The guard will not let me go in w
ithout something for the KING":ENDPROC
2690IFP%=17THENPRINT"The king is very fond of RABBITS
and    PHEASANTS!!!":ENDPROC
2700IFP%=44THENPRINT"WHY NOT"CHR$131"ENTERTAIN"CHR$129
"the King as your guest"CHR$129"in the Ogre's cottage."
CHR$131"WHO KNOWS?":ENDPROC
2710IFP%=13THENPRINTCHR$129"The guards only let visito
rs bearing   "CHR$131"GIFTS"CHR$129"of RABBITS in!":END
PROC
2720IFP%=45THENPRINT"The Miller's son is getting on we
ll withthe princess!"'"I'd just wait around a bit to se
e what  happens!":ENDPROC
2730IFP%=35THENPRINT"The King will be riding by shortl
y why  not hide the clothes!":ENDPROC
2740IFP%=36THENPRINTCHR$131"Those bushes look good for
 hiding things!":ENDPROC
2750IFP%=28THENPRINTCHR$129"A WEDDING ring could come
in useful!":ENDPROC
2760IFP%=50THENPRINT"When I forget something I often P
RAY!":ENDPROC
2770IFP%=30THENPRINT"DON'T touch the knife!!!":ENDPROC
2780IFP%=33THENPRINTCHR$129"Have you got the key?":END
PROC
2790PRINT"I'm sorry I don't have a clue!":ENDPROC
2800DEFPROCpush
2810K=1
2820PRINTCHR$129"Do you always have to be so stupid?":
ENDPROC
2830DEFPROCjump
2840K=1:PRINTCHR$131"Not likely. I might break my neck
!":ENDPROC
2850DEFPROCwait
2860K=1:PRINTCHR$129"O.K.":K=1:TIME=0:REPEAT:UNTIL TIM
E>200
2870IFP%=45THENPRINT"Well that seems to have done the
trick! The Miller's son proposes marriage to   the prin
cess and she agrees. The King   puts me in a carriage!"
:P%=46:ENDPROC
2880IFP%=46THENPRINT"O.K. The carriage comes to rest a
nd theyall get out!":P%=47
2890ENDPROC
2900DEFPROCrun
2910K=1:IFP%<>37THENPRINTCHR$131;"I'm too tired to run
!":ENDPROC
2920P%=38:PRINTCHR$131"O.K. I run as fast as I can!":W
%=W%+1:ENDPROC
2930DEFPROCvisit
2940K=1
2950PRINT"We have a visitor!"
2960ENDPROC
2970DEFPROCwear
2980K=1
2990IFAB=1THENPRINT"O.K. I will wear the boots!":FORH=
1TO3:IFV$(H)="a pair of boots"THENV$(H)=""
3000IFAB=1THENNEXT:AB=3:AQ$="a pair of boots:- worn
 PLUS":S%(11,3)=12:W%=W%+1:ENDPROC
3010PRINT"not yet!":ENDPROC
3020DEFPROCdress
3030K=1:IFP%=50 THENPRINT"One of the king's soldiers c
omes in and hits me on the head!":PROClose
3040M%=21:ENDPROC
3050 DEFPROCswear
3060K=1:CLS
3070FORX=1TO2
3080PRINTTAB(0,X);CHR$136;CHR$141;CHR$(128+X);"HOW DAR
E YOU SPEAK TO ME LIKE THAT!"
3090NEXT
3100TIME=0:REPEAT UNTILTIME=1000
3110X$(1)="The king's soldiers arrest me for        fou
l language!"
```




```
3120PROClose
3130DATAA shop assistant,21,a pair of boots,21,some co
ins,10,some lettuce leaves,7,an old bag,9,a fat rabbit,
12,a partridge,20,a rusty knife,30,a dead rat,25
3140DATAthe miller's son's clothes,35,some bushes,36,T
HE EVIL OGRE,39,some food,42,a gold wedding ring,28
3150DATAthe palace guard,13,A key,29
3160DATASHOP,1,ASSISTANT,1,PAIR,2,BOOTS,2,COINS,3,LETT
UCE,4,LEAVES,4,BAG,5,RABBIT,6,PARTRIDGE,7,KNIFE,8,RAT,9
,CLOTHES,10,BUSHES,11,OGRE,12,EVIL,12,FOOD,13,WEDDING,1
4,RING,14
3170DATAPALACE,15,GUARD,15,KEY,16
3180DEFPROCrabbit
3190K=1
3200IFAE=1THENENDPROC
3210IFAC<>1THENPRINTCHR$129"I need something to entice
the rabbit!"
3220IFAD<>1THENPRINTCHR$129"I need a bag to catch the
rabbit!"
3230IF(AC=1ANDAD=1)THENPRINTCHR$129"I put some lettuce
leaves into the bag."CHR$129"and the rabbit rushes ove
r."'CHR$131"I quickly trap the rabbit.":AE=1
3240IFAE=1THENS%(13,2)=14:O$(13)=LEFT$(O$(13),21)
3250ENDPROC
3260DEFPROCgift
3270K=1:W%=W%+1:AE=0:FORX=1TO3:IFV$(X)="a fat rabbit"T
HENV$(X)=""
3280NEXT
3290PRINTCHR$129"The guards take my"CHR$131"GIFT"CHR$1
29"of a "'CHR$131"RABBIT"CHR$129"off me and present it
to the"'CHR$129"King."
3300PRINTCHR$130"He is very pleased and asks for a "'C
HR$129"PARTRIDGE"
3310ENDPROC
3320DEFPROCgift2
3330K=1:IFAF<>1THENPRINT"I don't have it dummy!!!":END
PROC
3340PRINTCHR$129"The King thank's me Kindly and calls
"CHR$129"his dogs out of the way to let me pass":S%(17
,3)=30
3350SB=1
3360W%=W%+1:O$(17)=LEFT$(O$(17),22):ENDPROC
3370DEFPROCunlock
3380K=1:IFP%<>33THENPRINTCHR$131"Not here & now!":ENDP
OC
3390IFAG<>1THENPRINTCHR$129"I need a key":ENDPROC
3400PRINT"O.K. The gate is unlocked!":O$(33)="by an op
en gate!":S%(33,2)=34:W%=W%+1:ENDPROC
3410DEFPROChide
3420K=1:IFP%<>36THENPRINT"I can't hide anything here!"
:ENDPROC
3430IFAH<>1THENPRINT"I haven't got anything to hide!":
ENDPROC
3440FORX=1TO3
3450IFV$(X)=G$(10)THENV$(X)=""
3460NEXT:AH=0:W%=W%+1:PRINT"The King rides past your m
aster (the    miller's son) and sees that he is in    d
istress. He takes your master for a    ride in the roya
l carrage and you run    on ahead!"
3470P%=37:ENDPROC
3480DEFPROCmagic
3490K=1:IFP%<>39THENPRINT"I can't do that here!":ENDPR
OC
3500IFSD<>0THENENDPROC
3510CLS:PRINTCHR$129"O.K. I ask the OGRE if he can tur
n into"CHR$129"something."
3520PRINTCHR$131"He says 'OF COURSE I CAN!'"
3530SD=1
3540PRINTCHR$131"What would you like me to turn into"
3550INPUTZ$:C$=LEFT$(Z$,3)
3560IFC$<>"MOU"THENX$(1)="He turns into a TIGER and ki
lls me":PROClose
3570CLS:PRINT"The OGRE turns into a mouse!"
3580PRINTCHR$129"I pounce upon it and kill it!":G$(12)
="a dead mouse":S%(39,2)=40:W%=W%+1
3590N$(15)="MOUSE":N$(16)="DEAD"
3600O$(39)=LEFT$(O$(39),40)
3610ENDPROC
3620DEFPROCentertain
3630K=1
3640IFP%<>44THENPRINT"Don't be silly!"'CHR$131"How can
I do that here!!!!":ENDPROC
3650W%=W%+1
3660PRINTCHR$131"O.K. I invite the King and his daught
er"CHR$131"into the Ogre's cottage"
3670PRINT"The Ogre's servants provide a slap up    meal
and the King is most impressed"
3680P%=45:ENDPROC
```

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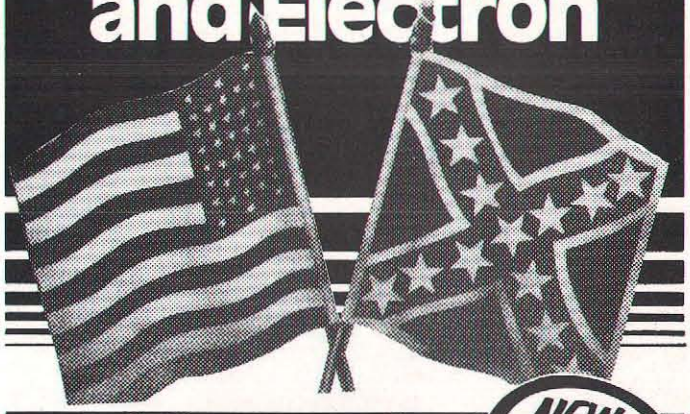

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ROMS

SOFTWARE FOR THE BBC MICRO

```
WORDWISE
(C) Computer Concepts 1982

 1) Save entire text
 2) Load new text
 3) Save marked text
 4) Load text to cursor
 5) Search and Replace
 6) Print text
 7) Preview text
 8) Spool text

ESC Edit Mode

Please enter choice_
```

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£39.00 + £1.00 p&p + VAT

```
  A=FF    X=FF    Y=FF
S =01FF 88 10 E3 BF 92 93 DC 89 ........
PC=FFFF DC FF FF 09 D0 00 00 FF ........
        777
   CFF0 48 4A 4A 4A 4A AA BD 1F HJJJJ...
   CFF8 C3 05 D2 45 D3 91 D8 98 ...E....
M =D000 18 69 08 A8 68 29 0F AA .i.h)...
   D008 BD 1F C3 05 D2 45 D3 91 .....E..
   D010 D8 98 E9 08 A8 10 D7 60 .......`
   D018 98 E9 21 30 FA A8 B1 DE ..!0....
-----------------------------------------
! START=D000
!D START START+9 S
D000 18          .    CLC
D001 69 08       i.   ADC #8
D003 A8          .    TAY
D004 68          h    PLA
D005 29 0F       ).   AND #F
D007 AA          .    TAX
D008 BD 1F C3    ...  LDA C31F,X

!LVAR
START D000
!$M=START
!
```

GREMLIN 32K

The GREMLIN system is a powerful de-bugging tool for 6502 machine-code programs. It includes all the usual features found in good machine-code monitors, such as memory search, intelligent memory move routines, memory editors etc. These work at byte, word or string level. A built in help menu can also be displayed at any time.

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£28.00 + £1.00 p&p + VAT

```
DISC DOCTOR 1.07
  DIS <<sta>> <<end>> <<ofs>>
  DISCAPE <afsp> <<afsp>>...
  DOWNLOAD <fsp> <<adr>>
  DSEARCH <str> <trk> <<trk><sct><drv>>
  DZAP <<trk>> <<trk><sct><drv>>
  EDIT <<key no.>>
  FIND <str>
  FORM <drv> <no. trks> <<stt>> <<S>>
  JOIN <fsp> <afsp> <<afsp>>...
  MENU <<drv>>
  MOVE <<dest page>> <<src page>>
  MSEARCH <str> <<adr>>
  MZAP <<adr>>
  PARTLOAD <fsp> <ofs> <ext> <adr>
  RECOVER <trk> <sct> <sct> <adr> <drv>
  RESTORE <trk> <sct> <sct> <adr> <drv>
  SHIFT <src> <dest> <ext>
  SWAP <<drv>>
  TAPEDISC <<fsp>>...
  VERIFY <<drv>> <<no. trks>> <<stt>>

OS 1.20

Press any key_
```

DISC DOCTOR 32K

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```
TERMI - BBC TERMINAL PROGRAM RELEASE 2.0
        FROM COMPUTER CONCEPTS
    (C) D.J.Martin and M.Miles  1983
------- Function key definitions -------

Key --- Key use --- Key with  Key with
No.                 SHIFT     CONTROL

f0  Printer         Start     Stop
f1  Change Mode     ASC char  ASC char
f2  Spooler         Start     Stop
f3  Transmit file   Start     Abort
f4  Transmit file   Pause     Continue
f5  Emulate         Custom    BBC
f6  Set handshake   XON/XOFF  None
f7  Special funct/n OSCLI     Set Mask
f8  Special Options Full/Half Parity
f9  Reset           Soft      Hard

        SHIFT/CONTROL FUNCTION KEYS

f0  Print Screen.
f1  Mode 7
f9  Reset XMIT block.
```

TERMI 32K

This program enables the BBC machine to act as an advanced terminal when connected to another computer or to a modem via the RS-423 (RS-232) interface. This provides facilities to transmit data from disc and the spooling of data from the 'line' to the disc or printer.

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Eprom Utilities

Trevor Attewell

Page a programming utility. A&B takes a look at two helping hands in ROM form.

Both these products are paged ('sideways') ROMs containing various utilities. The advantages of this format are fast access, and non-use of user memory when not in operation.

M'AIDEZ!!

'AIDS' may not leap immediately to mind as a name likely to encourage contact between a product and the public, but at least its connotations make it memorable. It is sold by SoftSmith, 9 Back Green, Hersham, Surrey, KT12 4HY, price £12.95, and provides five utilities of which one is 'hidden', as we shall see.

AIDS is normally supplied in a slow version (450 ns), catered for by inserting it in IC100 (the second socket from the right) and changing link S18. This only affects the speed of AIDS itself, which is unlikely to be noticed, but it seems an unnecessary economy, and a normal-speed alternative can be had for an extra £2. Some 'slow' AIDS will run at normal speed, but I do not recommend this — the review sample did so for a while from cold, subsequently causing problems in the DFS, for logical reasons concerned with the O.S. A much bigger snag is that AIDS is a 4k EPROM, requiring a connection change by switch link S33, which affects both IC100 and IC101. Thus only 4k EPROMS can be used in *either* position! This restruction is irksome, and difficult to justify at the current price of 8k EPROMS.

When invoked AIDS offers a menu of 5 items, the last of which uses the 'P' key as a double-action switch to turn the printer on or off, the current state being shown. All displays are black and white when printing. The first option is a disassembler, which asks for a start address and file name — if a name is entered the disassembly is limited to a line number, the address in label form (.£ABCD) and the mnemonic, to allow reassembly at a new location (in which case any absolute addresses must be changed, using the AIDS Replace option). The file is saved automatically, and the printer will not work in this mode. The non-file mode gives the usual format of location, code, mnemonic and ASCII, in paged mode. There are no jump, backspace or editing facilities. AIDS will disassemble itself, and programs are given in listings by which the BASIC and other ROMS can be relocated for disassembly. AIDS makes use of some user reserved zero page locations, but preserves the contents of these and replaces them on exit.

```
ENVELOPE EDITOR                    0 TO 255

Envelope number (1-15) <1 >

Amplitude              Pitch

AA =   50              PI1=    0
AD =   40              PI2=   65
AS =    0              PI3=    0
AR =  -50              PN1=   10
ALA=   30              PN2=   50
ALD=    0              PN3=    0

Step length x 0.01 sec =      0
Auto-repeat pitch envelope?   Y

SOUND Parameters:

Channel     1    Pitch      100
Envelope    1    Duration   100

Select : A  N  P  Q  TAB          <60_ >
```

UROM — Envelope Editor. Cursor at AR indicates parameter to be changed — 0 TO 255 (top right) is permitted range

The Memory Editor prompts for a start address, from which locations, hex bytes and ASCII equivalents are listed, also in paged mode. The vertical cursor keys merely move the cursor up and down the first column of bytes, while the left and right keys ar used for forward and backward paging. On pressing 'COPY' an edit mode is entered, but editing must be done on every byte in a row until the last (or only) one to be altered is reached, using a *contiguous* row of replacement bytes, any space being treated as a '0'! True, the cursor keys can be used to copy unchanged bytes (dodging the spaces!), but I found this an uncomfortable facility.

Search and Replace looks for any string of up to 30 characters, not including line numbers or BASIC keywords, though the latter can be found if the token is entered by suitably pre-programmed soft keys. More usefully, a wild-card character is accepted in any position except the first to cope with related words, spelling mistakes. etc. When a match is found, the complete BASIC line is displayed with the string highlighted. One key stroke replaces the selected string if required, but the replace string cannot be longer than the search string. The line can be edited after escaping to BASIC. Other options return to BASIC with the remainder of the program listed, or print the memory start address for the line. It is this utility which contains the 'hidden' one, a 'Bad Program' fixer. Any use of the search routine (including a search for a zero string) automatically repairs a corrupted program as far as possible, replacing codes lower than &20 by '@', correcting line length bytes and inserting the &FF terminator where necessary. While it may not recover everything, it is a big improvement on losing the lot!

A Variable Dump lists all variables in a BASIC program *except* resident ones (A%-Z%), and gives their current values. Array sizes are given, but not their contents, and floating point numbers are limited to two decimal places with accuracy +0, −0.02 and maximum range 0.01 to 10. This range and accuracy is practically useless in many scientific and educational programs.

In general I found AIDS not particularly friendly. Displays and prompts are rather spartan, and not very invitingly laid out. Invalid addresses are accepted, leading to predictable confusion. The instruction manual is clear and comprehensive, though the page on BASIC keywords would be improved by using the standard CTRL symbol(¦) throughout instead of a colon with two meanings. The relatively low cost of this ROM should be borne in mind, but the hardware restrictions it imposes and the limited number of facilities offered are distinct drawbacks.

UROM

This contender comes from J & H, "The Elms", Sussex Road, Southport, PR9 0SJ, price £19.95. It embraces a dozen utilities in an 8K EPROM which will fit in any spare socket without annoying its neighbours. It is called in the usual way ('*U.' will normally suffice), and offers a menu. The utilities can be grouped arbitrarily under about six headings, starting with disassembly. The disassembler itself is standard, giving location, codes, mnemonics and ASCII, with the addition of decimal equivalents for operands and absolute addresses for relative branches. The screen shows one group of 21 lines at a time, updated by one key entry, but backspacing is only possible by issuing a new start address. Code can be dumped to printer if required. A separate 6502

```
PROCESSOR STATUS

AC = 34    XR = 36    YR = 7A    SP = EF

P-COUNTER = 8000

FLAGS : N V - B D I Z C
        0 0 1 0 0 0 0 0

MEMORY:        STACK      NEXT INSTRUCTION

(0070)= 00     0E         JMP  &9D90
(0072)= 97     33
(0074)= 02     B4
(0076)= 34     EB
(0078)= 00     97
(0080)= 08     04
(0082)= 00     01
(0084)= 00     04
               F1
               7D

Select : C E P R S X OPTION <E>
```

UROM — 6502 Monitor showing first UROM JMP instruction at language entry.

monitor displays A, X and Y, the stack and P counters, the status register flags, the top 10 bytes of the stack and the contents of up to eight selected memory locations. The next instruction (disassembled) is also given. This monitor will execute a complete code from the P-counter position (which can be altered at any time), or step by step. In stepwide mode jumps are followed unless avoided by a 'skip' option. These are useful 'bread-and-butter' facilities.

There are two search utilities. 'Find and Replace' works on a resident BASIC program but is only concerned with variable names, including Functions and Procedures, which can be located and substituted. Normal strings and keywords are not handled, and 'Replace' gives no warning if the target string is not found, merely flagging 'Replacing complete'! The most likely use is for replacing long variable names used in program development by shorter, space-saving ones. Either name may be up to 15 bytes long, and may contain any letters and numerals, other characters being officially limited to £, % and &, though I found that the underline character beloved of many programmers is accepted. There is also a memory string search that prints the start location of each occurence. Only seven bytes are accepted, in hex or character format, and the memory search range is &100 to &7FFF. To examine any such occurrences you must note them down and call the memory dump, which is inconvenient.

The memory dump displays the contents starting from PAGE, 128 bytes at a time. Once called, the start address can be changed, and the display can be clocked forward or back by 128 bytes at a time. Alternatively, the complete display can be moved on by a few lines (maximum nine). A specified range of locations can also be dumped to a printer. The contents of any location can be changed, but each such location must be specified individually, which is rather tedious. Blocks of memory can be moved without any limit on size or the start and destination addresses, (apart from the obvious operating system requirements). UROM will move itself or anything else, by as little as one byte if needed. The length of the block is displayed in hex and decimal, and moving a 16K block took under a second.

Among some miscellaneous commands are two dealing with the soft keys. The first displays their current contents and the second sets them up (except Key 9) with various commonly used programs. The usefulness of these is simply a matter of individual taste. Another pair of commands handle sound envelopes, the first allowing the sound to be defined or edited while the second provides the required BASIC envelope statement. The sound editor needs practice in use — after specifying an envelope number you move a cursor around all parameters one at a time by the TAB key — no going back except by going round again! Values (initially zeroed) are changed by pressing 'A' after which a new number *must* be entered, even if you have pressed 'A' by mistake, in which case the only escape is to insert the number already there! The sound can be played, and stored. This is an original feature which should be helpful to anyone putting sounds into programs.

A simple character definition program is included, in which an 8 × 8 grid of asterisks is scanned by the cursor controls while the space bar exchanges them for minus signs or vice versa. You may start with the square filled or empty, and the appropriate VDU parameters are updated as the design proceeds, after which pressing RETURN displays the full code and enters the character into the buffer at &COO. The final utility is a 'Bad Program' repair which carries out the usual format checks on a resident BASIC program, correcting line length bytes, inserting a terminator if required, and replacing control codes by '@'. It worked on both a deliberately corrupted

CONTINUED OVER

```
Memory Editor

CURSOR keys for Block/Row
COPY for Write

8000 00 00 00 4C 22 80 80 11   ...L"...
8008 01 41 49 44 53 00 31 2E   .AIDS.1.
8010 30 00 28 43 29 38 33 20   0.(C)83
8018 53 6F 66 74 53 6D 69 74   SoftSmit
8020 68 00 C9 04 F0 47 C9 09   h....G..
8028 F0 01 60 8A 48 98 48 A0   ..£.H.H.
8030 00 B9 09 80 F0 06 20 EE   ......  .
8038 FF C8 D0 F5 20 96 8A A0   .... ...
8040 00 B9 0E 80 F0 06 20 EE   ......  .
8048 FF C8 D0 F5 8D FF 07 68   .......h
8050 A8 68 AA AD FF 07 60 20   .h....£
8058 F8 8A 20 03 8B 20 D4 88   .. .. ..
8060 A2 20 BD BF 07 95 6F CA   . ....o.
8068 D0 F8 8A F0 DF 8A 48 98   ......H.
8070 48 A2 00 BD 09 80 F0 0C   H.......
8078 D1 F2 D0 04 C8 E8 D0 F3   ........

Space for Menu, Escape to Exit
```

AIDS — Memory Editor

program and on bad cassette loads.

The general implementation of this ROM is good, but I wish it was more friendly in use. Returning to BASIC or to the menu is a little fiddling in many cases, most key choices need RETURN , and hex entries must be 4-digit, including leading zeros. While onward progress is usually straightforward, UROM is less forgiving it you slip up and wish to go back — this often requires a BREAK and re-start. UROM borrows some zero-page locations (not &80 to &8F) which do not affect BASIC, but may upset some other services, since original contents are not replaced. Using UROM from WORDWISE (not that you often would) loses your text.

DO YOU SEE RED?

Both these utilities make extensive use of colour. This is fine on colour monitors, though some reds are not particularly visible even on these. However, many users prefer the better definition of black-and-white monitors on which some 'colours' are scarcely visible at all. It is perfectly possible to choose colours that work on both, reserving low-luminance ones for the least important detail. Programmers should examine the grey equivalents of the various hues, and consider whether colour is being used helpfully or merely because it is available. The screen photographs were obtained using a simple circuit to derive an all-white video output from the RGB and synch signals. The gadget might interest readers, and DIY details may be available shortly.

It is difficult to compare items of firmware directly on merit — an excellent utility is worth little if you don't need it, while the converse might equally well apply! The simplest answer is to rate them as A&B does software. In this context 'Technical' refers to the technical design and implementation, including interfacing with other parts of the system, also quality and workmanship where applicable. 'Facilities' considers the number provided, their logicality and usefulness in the intended (or most likely) application. 'Documentation' embraces presentation, completeness and accuracy. The other criteria are self-explanatory!

	AIDS	UROM
TECHNICAL	30%	70%
FRIENDLESS	50%	50%
FACILITIES	40%	70%
DOCUMENTATION	75%	75%
VALUE FOR MONEY	40%	70%

```
USER-DEFINED CHARACTERS

(A)mend,(C)reate or (Q)uit ?  <_>

Character number ? (224-255)  <246>

        --------      0
        --***---     56
        -*---*--     68
        *-----*-    130
        *-----*-    130
        -*---*--     68
        --*-*---     40
        ***-***-    238

VDU PARAMETERS:

23,246,0,56,68,130,130,68,40,238
```

UROM — character completed and defined. Selecting "Q" necessitates another choice between BASIC and Menu.

```
AIDS
SoftSmith
                                Printer

Initial to Select

        Disassembler
        Memory Editor
        Search/Replace
        Variable Dump
        Printer
_
```

```
Search? grounded

Replace? earthed

 2570  PRINTTAB(2,6)"Current elim.:";Mi;
TAB(19,6)"Node  grounded  :";Ni
 1EFC
 Replaced
 2850  PRINTTAB(7,6)"3.Change  grounded
 node"
 Replaced

The End

Space for Menu, Escape to Exit
_
```

AIDS — Search/ Replace (1EFC is first memory location, produced by pressing "&"

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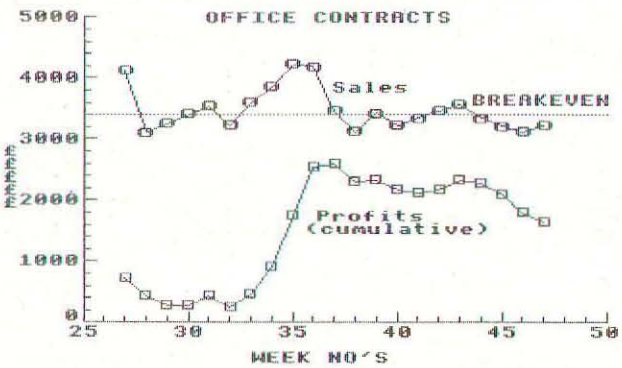
EASIPLOT

The professional graph program for the BBC Micro (Model B only)



EASIPLOT is a commercial graph drawing packaged designed to be so simple to operate and understand that schoolchildren, businessmen and even users with only a rudimentary knowledge of the BBC keyboard, can produce a professional graph or chart with equal ease. This program was placed among the top twenty educational packages by Educational Computing Magazine.

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Edsoft

Title: Music
Publisher: Edsoft
Machine: Model B
Price: £9.95

Music is a very simple question and answer test program involving the printing of notes on a representation of a musical score and the congratulation or correction of the child's input.

Unfortunately there are a couple of small things which spoil the program. The first is the fact that no realistic musical notation has been defined (apart from a treble and bass clef, which are drawn). A 0 character is used to indicate the position of the note either on the line (E to F) or between lines (D to C) in the treble clef. The second is that the keyboard is not properly disabled when an input is being asked for. Pressing the Spacebar for instance results in its interpretation as a wrong answer. This is very discouraging for a child using the program for the first time. Only the relevant keys should remain active. Every time a wrong answer is returned the program repeats the question but there are no facilities for a parent or teacher to monitor problem areas.

What are good are the sounds for 'well done' and 'sorry, wrong'. The authors have hit upon the right tone for these aural communications. All in all however, I think that one of the BBC sound utilities (I am especially thinking of System Software's Music Editor) would provide a better means of teaching note position. This program does not improve on any traditional teaching method.

Ratings Table

SOUND	40%
GRAPHICS	50%
DOCUMENTATION	60%
VALUE FOR MONEY	30%
OVERALL	40%

Title: Electricity
Publisher: Primary Programs
Machine: Model B
Price: £3.95

This program turned out to be an excellent demonstration in simple graphically represented stages, of a circuit. This is built up step by step from battery to motor via resistor, switch and bulb. The program demonstrates the effects of various different combinations of wiring. In fact there are three individual programs using most of the procedures in common but offering slightly different facilities.

Each stage offers a menu of components to choose from and the ability to connect, disconnect and switch on. In one option the discipline that all the items have to be connected up is added, in another only five wires are supplied for connections to be made.

While there is no better way than using the actual components when learning the basics of how electricity behaves, this has to be the next best thing. It has the added advantage of visually displaying the direction of current and clarifying the operation of a simple circuit by using animation and colour. There is no credibility gap because of the excellent presentation and clearly worded prompts. One simple and essential feature is the disabling of all the unnecessary keys when an input is asked for.

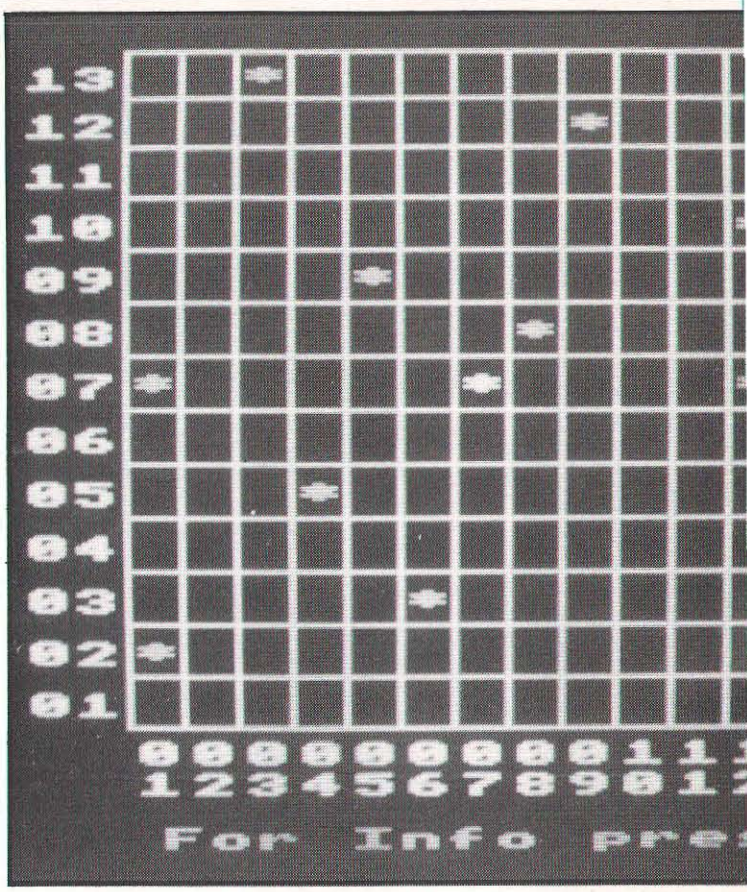
Ratings Table

SOUND	N/A
GRAPHICS	75%
DOCUMENTATION	80%
VALUE FOR MONEY	90%
OVERALL	80%

Title: Campaign
Publisher: Longman
Machine: Model B
Price: £16.68

This is a piece of educational software produced by the 'Computers in the Curriculum' project at Chelsea College. It is an historical analysis of Edward III's campaign in France that led up to the battle of Crecy. The package consists of the cassette tape, a 14 page A4 booklet, and five students' leaflets. All this is packed into a single A4-sized folder.

The idea of the package is that the teacher introduces the subject as a lesson, perhaps as a part of a series of lessons on the Hundred Years War. The lesson would begin with a talk on the



events leading up to Edward's invasion of France and his initial moves on the Continent. Then the computer would take over.

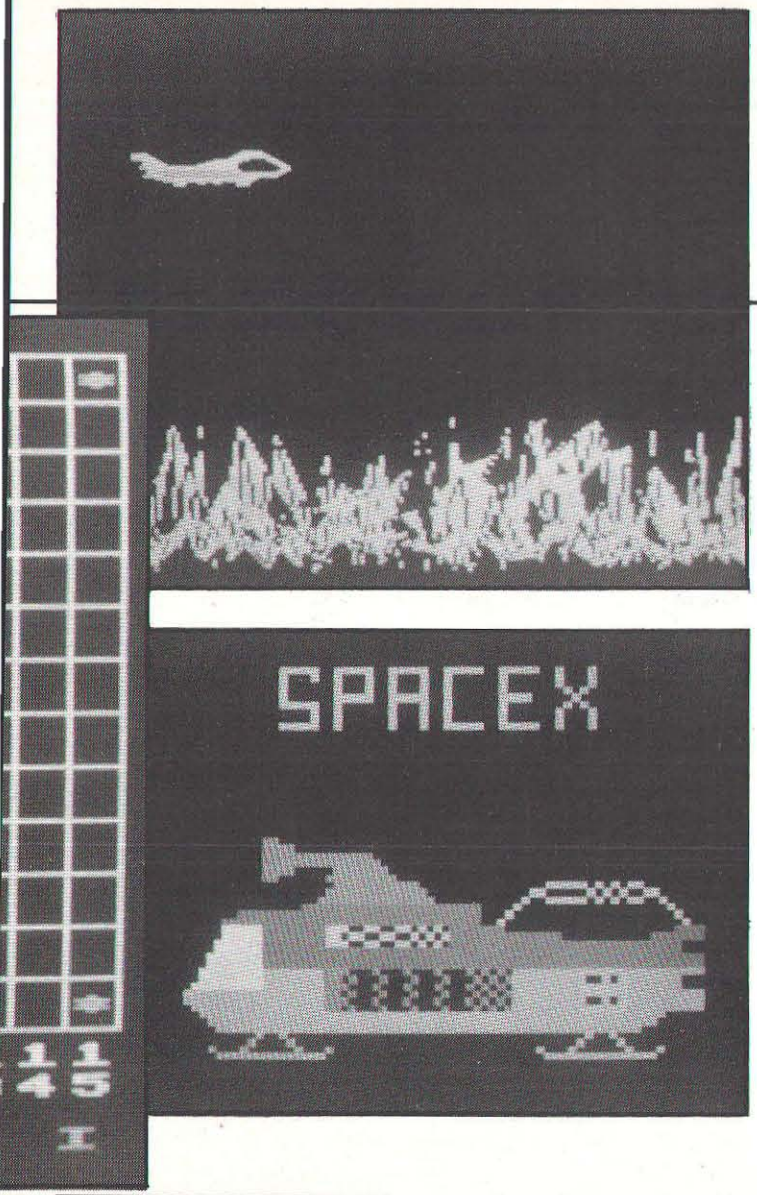
The program presents a series of scenarios that Edward historically faced followed by multiple choice questions. When you give your choice of answer the computer gives an analysis of the possible outcome of your choice and then either returns you to the question or passes you on to the next question. Or to put it another way, it takes the dangerous view that the historical choice must be best because it led to victory.

If you analysis the decision presented as correct there are several points at which a decent argument could be made for the opposite case. For instance, at one point during the battle of Crecy the right wing of the English army is engaged and in danger of defeat. Edward refused to commit his reserve and the wing held. The program takes the view that to commit your reserve is therefore wrong. But a good case can be made that the reserve should have been committed, and Edward was just very lucky.

I would not rate this package too highly as a learning device. As a Visual Aid in an already structured lesson it may have a place, but as a turtorial tool it would be of very limited use. It will make more work for a teacher than it will save, so its only advantage will be the novelty of using a computer in a history lesson. The additional problem of a serious printing error in the package only helps to add to the work.

Ratings Table

SOUND	N/A
GRAPHICS	N/A
DOCUMENTATION	80%
VALUE FOR MONEY	60%
OVERALL	60%



Title: Spacex
Publisher: 4 MAT
Machine: Model B
Price: £10.00

The scenario for Spacex is displayed on the screen while the rest of the program loads. To quote: "For two years the space research vessel, The Golden Hind, has been exploring the Ursula system. You belong to the team of scientists who have been working on the planet Persephone. The Golden Hand is now in orbit around Persephone waiting to take you back to Earth. Just as you are about to leave the planet to rejoin the Golden Hind you find that your shuttle has been broken into and several vital pieces of equipment have been taken. This is the work of the Kleptoes, a semi-intelligent species who are always collecting things and hiding them. Before you can leave you have to find the missing items."

It is just as well that this information takes several minutes to digest, because the program takes over six minutes to load. Having loaded the main program you are given more information to help you locate the missing items on the planets surface, which is divided up into a grid. A metal detection scan indicates in which locations metal objects are to be found, though doesn't guarantee that they are the ones that you are looking for. The scan does not show the nature of the ground or the location of geographical obstacles. You are told that the base has a forest, a lake, and a mountain range around it, but the location of these may only be found by exploratory missions.

To reach any location on the grid, it is necessary to fly the Land Skimmer by specifying the grid co-ordinates of the destination. The skimmer has a limited amount of fuel, and only room for five pieces of equipment which are chosen from a total of ten. It is necessary therefore to record all information about each flight and its consequences. Equipment may be exchanged by returning to base, but as this uses up fuel such exchanges must be well planned. All positions on the grid are fixed from game to game, so it is possible to progress, but only by getting killed and restarting.

As it is very easy to get killed or not have the right equipment at a particular time, this can be a frustrating game. The hand book accompanying the cassette suggests a number of ways that the game can be played as a class excercise, with a lot of ideas for discussion topics, other activities and follow-up ideas.

As a text only adventure game Spacex is rather limited, but given suitable development into a larger class activity, it could be a useful focal point for a teacher to develop a number of associated projects.

Ratings Table

SOUND	70%
GRAPHICS	65%
DOCUMENTATION	85%
VALUE FOR MONEY	80%
OVERALL	75%

Title: Towntest
Publisher: Silverlind
Machine: Model B
Price: £6.50

This is a program designed for schoolchildren (or adults, for that matter!) to test their knowledge of towns and cities around the British Isles.

On running, a high resolution map of the British Isles is displayed, with a flashing square on it. A list of 9 towns is shown, and user must type the number of the town corresponding to the position of the square on the map. If you choose the right town first go, a high pitched siren sound is awarded. If more than one go is taken, only a small beep is sounded. If a wrong answer is typed in, the computer will place a flashing square on the town you wrongly selected, and print "THAT'S HERE!"; thereby teaching the pupil where the other towns are as well as the correct one. If the answer is not known, pressing TAB will reveal all. When the pupil is bored, typing X will stop the quiz and list the results.

The program uses a very large number of towns; some I had never even heard of. However, a better randomizer is needed: I was given 6 repetitions of one town in 15 goes! There is also a bug that stops the program after about 60-70 goes; this is very frustrating, especially when you have been looking forward to getting the results.

Overall, I think if this program was refined (the bugs taken out, and the randomization increased) it would make good value educational software.

Ratings Table

SOUND	50%
GRAPHICS	75%
DOCUMENTATION	N/A
VALUE FOR MONEY	60%
OVERALL	55%

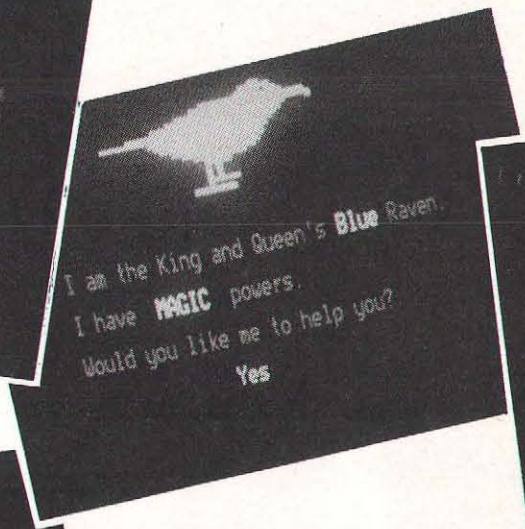
Title: Lines/Angles
Publisher: 4 MAT
Machine: Model B
Price: £5.00

The aim of these two programs is to introduce the program user to the concepts of horizontal and vertical, and to the right angle. The cassette contains one program on each side, and gave no loading problems.

The program Lines starts with a sequence demonstrating horizontal and vertical lines on the screen. This is followed by a question sequence where the program draws lines and the user is asked to state whether they are horizontal or vertical. The concept is expanded by the demonstration of a ship travelling horizontally and a helicopter travelling vertically, both accompanied by suitable sound effects.

The program continues by drawing a picture using a given number of horizontal and vertical lines. Two choices are given for each type of line, giving only four different pictures. This is followed

CONTINUED OVER



by the reverse, drawing two pictures, and asking how many of each line type there are.

The program Angles starts in similar fashion with a demonstration of a right angle in various orientations on the screen. The question sequence that follows shows a figure like a clock face with two hands, and the user is asked how many right angles there are in the figure.

The concept of bigger and smaller angles follows, with a demonstration and question sequence. The program finishes with the best part of either program. The program finishes with the best part of either program. A creature called Gobbler is drawn on the screen, and his mouth, arm and leg moved to form angles. The user is asked whether these are a right angle, bigger, or smaller. The angles are then changed and the questions repeated. This happens four times and may be repeated if wished.

Both programs have rather minimal content, with harsh sound effects that cannot be turned off. The use of colour text is quite good, but graphics content is almost non-existent. The handbook accompanying the programs gives some ideas for associated activities, but this does not make up for the lack of program content itself.

Ratings Table

SOUND	50%
GRAPHICS	70%
DOCUMENTATION	70%
VALUE FOR MONEY	70%
OVERALL	60%

Title: Granny's Garden
Publisher: 4 MAT
Machine: Model B
Price: £10.00

"The action takes part not in Granny's garden itself but in the Kingdom of the Mountains, a magical hand to which the program user is spirited. The King and Queen of the Mountains have been imprisoned in a secret cave by the Wicked Witch, and their offspring have been hidden away in four strange locations. To complete the adventure these missing children must be found." This is the scenario for an adventure game for children of seven years of age and upwards.

The game starts with twelve trees displayed on a 4x3 grid. The 'correct' tree has to be found, though as this is set purely at random, the guessing procedure can get rather tiresome. It is possible though to set the 'correct' tree so that the right guess can be made first time. At the same time as the tree is set, the sound may be switched off.

Having got passed the tree problem, the adventurer is into the game proper. The first location is the woodcutter's cottage. To find the first child, it is necessary to enter the cottage, explore the four areas within, and avoid being caught by the wicked witch. This is not so easy, and failure is greeted with a suitable nasty cackle and picture of a witch. Having been caught, it is back to square one again.

Solving the mystery of the cottage gains you a password that enables you to move on to location two, the giant's garden. Here there are five difficulties to be overcome, and five creatures to provide assistance. The solution is the easiest of the four locations — my five year old tester had no trouble getting past this barrier.

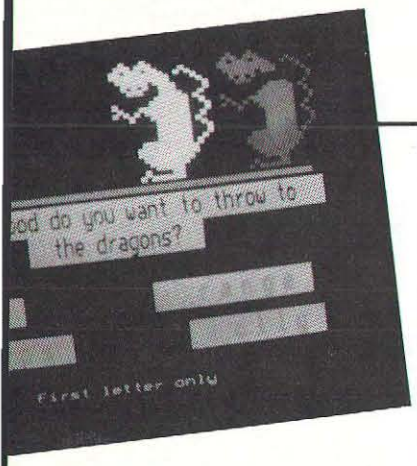
The first two problems having been solved, and two of the six children located, it is necessary to load the second side of the cassette. Having gained a second password for solving the problem of the garden, it is now on to location three — the city of dragons. Taming four dragons proved to be more difficult than appeared at first, until the instructions were read a second time — a little more closely. Dragon taming then being a little more easy, two more children were rescued and a third password was gained.

The final location is in the land of mystery. There are five locations and many problems to be solved to enable you to move about and locate the final two children. It is only too easy to get caught by the wicked witch, and a certain amount of perseverence is necessary to win.

The program shows imaginative use of both sound and colour, and the Mode 7 graphics are particularly good. The difficutly of the problems is about right for the proposed age group — my five year old tester could only solve one of four. A loading time of over five minutes is a drawback when working with young children, and it is advisable to have something else going on at this time. The small handbook that comes with the game has some ideas, and there are suggestions for group and follow-up activities. With suitable parental or teacher guidance, this program could be very useful in introducing the younger child to the logical solution of problems.

Ratings Table

SOUND	75%
GRAPHICS	80%
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	75%



Title:	**Pirate**
Publisher:	**Chalksoft/Ward Lock Educational**
Machine:	**BBC Model B**
Price:	**£8.00**

PIRATE is one of eighteen Chalksoft programs available to educational establishments through Ward Lock Educational. It is described as a two-part adventure game for children aged eight to twelve, featuring full colour graphics, animation and sound, which encourages strategic thinking and geographical skills as the child sails a pirate ship around an imaginary ocean, constructing his own map along the way. It is intended for group or individual activity and can be used as introduction to related topics: map making, explorers.

The INTRO program permits the user to choose several pages of instruction or proceed to the first part of the adventure. PIRATE 1 is automatically loaded from INTRO, and gives a menu which enables the user to RUN the program, LOAD or SAVE information from tape. The program starts from a new position each time, but the islands and coasts are always in the same place.

The effective graphics are a pleasing feature and add to the enjoyment of the program. 'Blow the man down . . .' and 'Life on the ocean waves' give a realistic atmosphere to begin with, but these, plus the few bars of music used to link the program, soon had me wishing there was a sound off routine — it was a relief to walk the plank occasionally! Presumably, program space did not permit alternatives — wave sounds for rocks, horrendous screams for the killing of the dragon!

Mutineers, magic cats, pirates, rocks and storms abound as the gallant captain navigates his ship over the ocean, visiting mysterious islands and collecting the necessary points and jewels to proceed to PIRATE 2. If you've been at sea too long, ESCAPE returns you to the menu and enables you to save your voyage for another day — only in PIRATE 1.

If you manage to overcome all the problems set in PIRATE 1, obtain enough points and jewels, and survive, you're allowed to proceed to PIRATE 2 — a doubloon for everyone reaching this stage! — which holds more 'adventures' on a pirate island and a lot more work before the king is found. Those rescuing the king deserve all the rewards heaped upon them — an extra half-hour on the micro after school!

PIRATE has many good ingredients, but some features I found rather repetitive and the operation of the program surprisingly slow. Initially, the program is highly motivating, but this can be lost very quickly if the voyage goes on for too long, the ship sinks or the captain made to walk the plank too many times with PIRATE 2 still out of sight over the horizon. Ward Lock would do well to look at the documentation provided by some of their competitors and thus make the program more 'teacher friendly', otherwise many an hour is going to be spent sailing the sea so blue with little to show at the end.

Ratings Table

SOUND	60%
GRAPHICS	80%
DOCUMENTATION	30%
VALUE FOR MONEY	70%
EDUCATIONAL	65%
OVERALL	65%

Title:	**Mr. T's Shape Games**
Publisher:	**Ebury Software**
Machine:	**BBC Model B (O.S 1.0 or above)**
Price:	**£12.95**

Ebury Software have produced a series of educational program under the title of Mr. T's Games for 3 to 6 year olds. Mr. T's Shape Games, like the other five games in the series, comes with an excellent ten page Parent's Handbook which takes you beyond simply telling you how to run the programs. Unlike some eductional software, every encouragement is given to discussion and activity between parent and child (and other children) before the BBC micro is even turned on.

Various activities have also been designed to be played afterwards in order to consolodate what has been learnt. The Handbook even gives an example of

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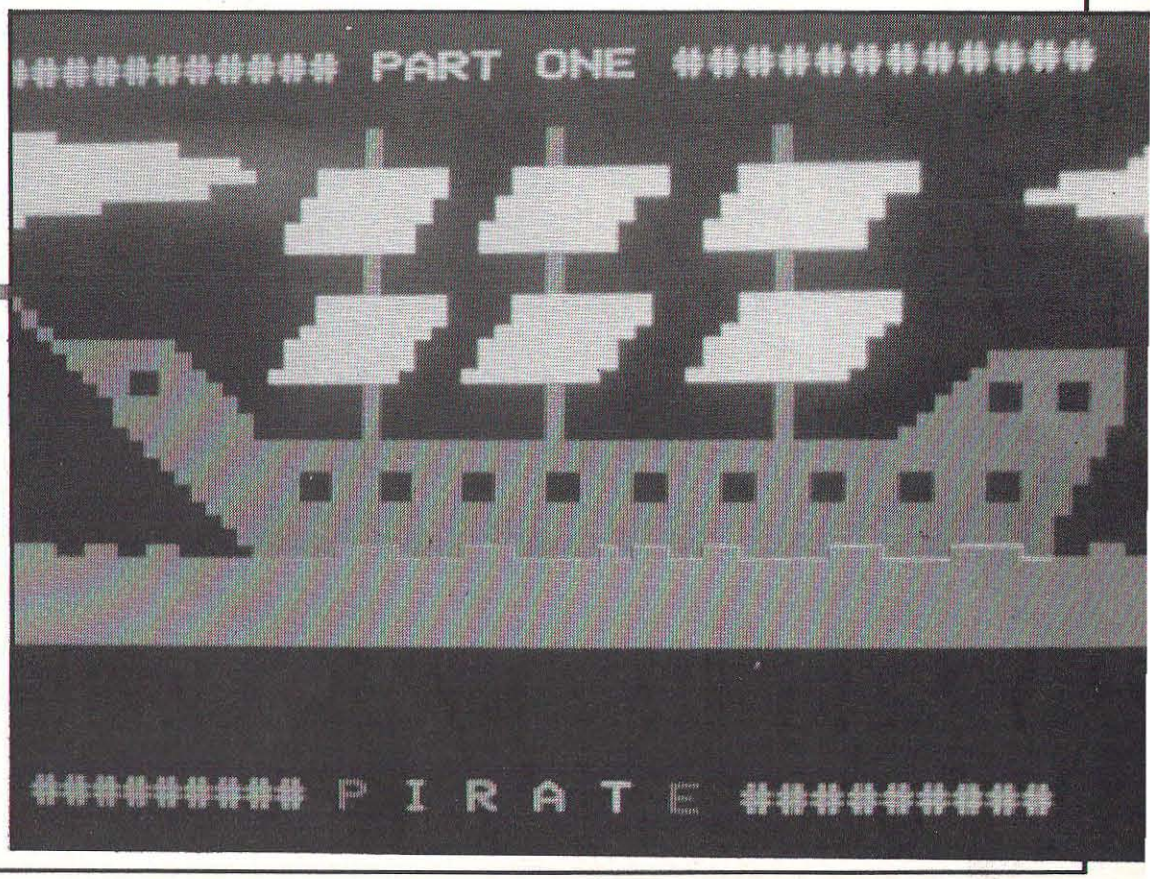


the sort of conversation which might take place between the adult and child to take advantage of what is being learnt.

Jigsaws is a very enjoyable first program. A pattern of shapes appear made up of squares, rectangles, triangles and circles. From the top of the screen a shape emerges and the child is required to press the space bar when this shape passes over an identical shape.

As with all the other Mr. T Games the level of difficulty can be controlled either by the adult or Mr. T automatically, depending upon the child's progress. The difficulty is determined by varying the speed of descending shapes, or increasing the complexity of the base pattern.

Whereas many of the Mr. T Games teach by improving performance on a task, Shape Maker focusses on creativity. This program allows the child to manipulate different geometric shapes — size, colour, movement around the screen, and rotation in 2D — and make pictures and patterns and so be introduced to basic notions of geometry. One small point; unlike most other Mr. T Games, Shape Maker has to be run on a colour TV, otherwise it is like playing snooker in black and white.

Ratings Table

SOUND	70%
GRAPHICS	80%
DOCUMENTATION	95%
VALUE FOR MONEY	80%
OVERALL	80%

Title:	**Mt. T's Money Box**
Publisher:	**Ebury Software**
Machine:	**BBC Model B (O.S. 1.0 or above)**
Price:	**£12.95**

In comparison with Number Games, Mr. T's Money Box is a poor relation. The aim of Money Match is to match a coin in the centre of the screen with one of seven coins in an outer ring. This is done by pressing the space bar when a pointer is on a matching coin. The coins are made different in terms of size, shape or colour.

However, the size of the coins (eg. 5p and £1, and 2p and 10p) is not sufficiently different, so that even when an adult tries to match, there is a fair chance that mistakes will be made. This is even more likely if you use a black/white TV.

The graphics and the reward for the correct answer are rather dull. So much so that my five year old son preferred getting the wrong answer because the sound and graphics then produced were marginally more interesting.

The game has various levels of difficulty. For example, at the easiest level the child matches against two coins. At the most difficult level, the choice is between seven coins.

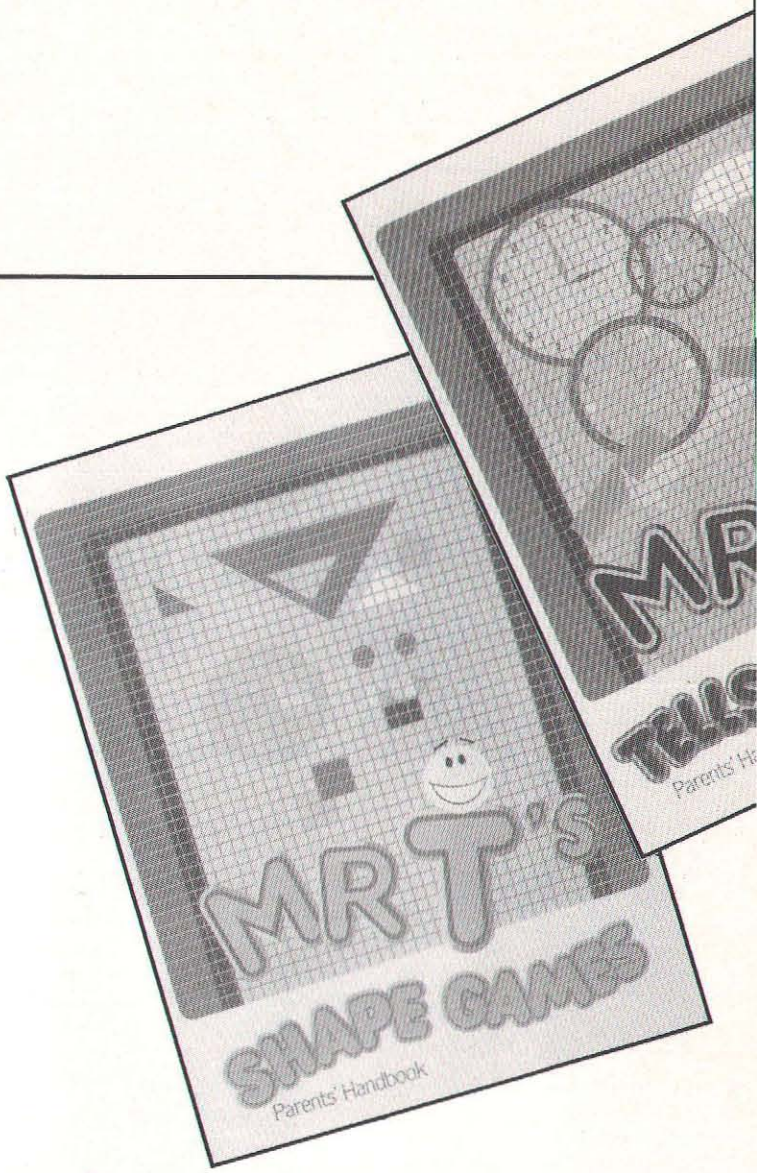
Money Box is more imaginative and requires an adult's active involvement. Mr. T asks for a coin which is either different to the one presented, worth more, worth less, sometimes more/less, and at the hardest level worth more/less than two coins which are presented. Everytime the correct answer is given the money goes into your money box; when wrong, the money is lost. Again, recognising that the computer cannot do the whole job of teaching, the child is encouraged to play the game with coins at the same time, thereby making real and reinforcing what is learnt. With the emphasis place on discussion in all of these activities, the games should also help develop a child's vocabulary.

Ratings Table

SOUND	55%
GRAPHICS	60%
DOCUMENTATION	95%
VALUE FOR MONEY	50%
OVERALL	55%

Title:	**Mr. T's Number Games**
Publisher:	**Ebury Software**
Machine:	**BBC Model B (O.S. 1.0 or above)**
Price:	**£129.95**

Mr. T's Number Games, like Shape Games was written by Five Ways Software. Anyone who is familiar with their programs 'Imposters' or 'Staying Alive' in the Natural History Museum, London, will not be surprised to learn that this program is highly imaginative with good use of graphics/sound and great fun to play.



The first program comprises five games of increasing difficulty. Although some of the games can be played by the child alone they all benefit from another person's (adult or older child) participation.

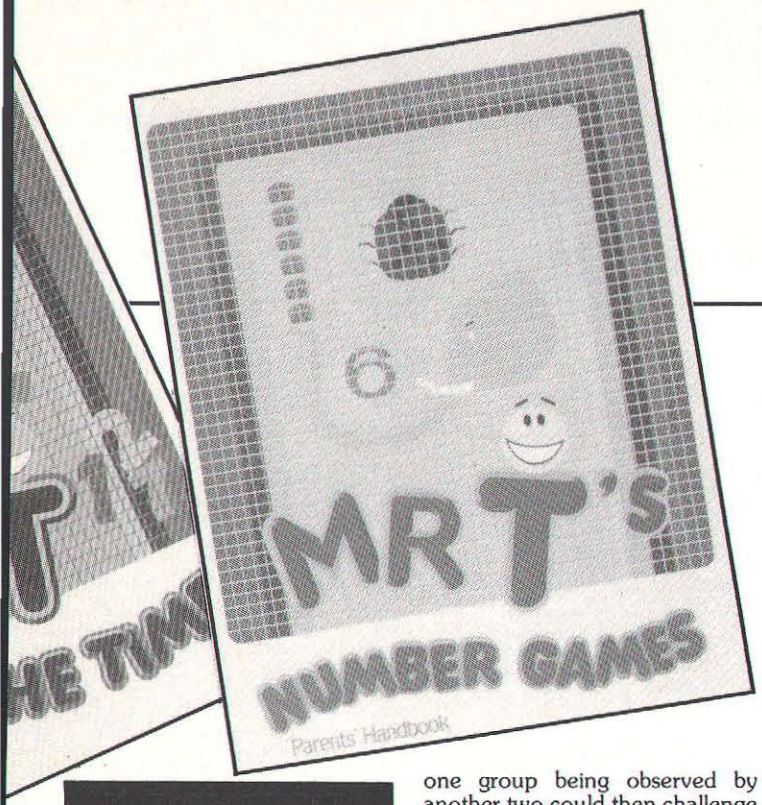
How Many? begins with the spots (between 1-5) on the back of a ladybird flying through the air and landing on a leaf. The child has to count and return each spot to the ladybird. When the child gets the correct answer the ladybird marches off the screen to different tunes. The game then develops to include more spots and the learning of figures. In the final game, the beautifully drawn ladybird reappears with a varying number of spots and the child has to press the correct number. After getting nine correct answers, Mr. T appears and waves to a tune which sounds as if it's played on a harpsichord. This game therefore teaches the child about numbers counting, and the use of the keyboard.

Elephant Game is equally imaginative. It is best played with another child. Cooperation rather than competition is the key as the players have to ensure that an elephant with an insatiable appetite has a constant supply of buns and water. This is done by the child tapping out the correct number of keystrokes or number in response to a number prompt.

The programs in this series are fairly pricey, but this Mr. T game is especially good value.

Ratings Table

SOUND	95%
GRAPHICS	90%
DOCUMENTATION	95%
VALUE FOR MONEY	90%
OVERALL	90%



Title:	**Survival**
Publisher:	**SYSTEM**
Machine:	**BBC B**
Price:	**£14.95**

This is an interesting and original package for use in Social Studies classes, Humanities courses of Social Psychology tutorials. The aim is to explore social interaction and the development of social groups by giving students the chance to see such a group in action. There is no point whatsoever in using this package in any other situation as it is meant to provide the stimulus for interaction between individuals. As I said it is both original and unique as a computer package although other techniques have been used previously.

The package consists of a disc and a manual containing both student and tutor notes. It is used by getting a group of students to take part (between 5 & 9 students is ideal) in the scenario it suggests. They are briefed as a group stranded on a barren and airless planet and they have to complete various tasks in order to get enough air and credits to escape. The situation is so weighted that there is now way an individual can escape without the help of the others and hence the social group development and possible co-operation or conflict between individuals. This gives the students the possibility of analysis of motive and action at the end of the session although I would prefer to use the package with one group being observed by another two could then challenge the 'guinea pigs' on their contributions.

Having taken part in such scenarios before I can appreciate how valuable this package could be to the tutors involved, as it leaves them free to take notes and observe fully, whereas they normally have to act as both stimulus and referee. The tasks demand enough different skills and styles to be taxing for a group yet realistic enough to seem worthwhile. A well thoughtout and planned package but for the specialist only.

Ratings Table

SOUND	50%
GRAPHICS	60%
DOCUMENTATION	90%
VALUE FOR MONEY	90%
OVERALL	90%

Title:	**Monster Maths**
Publisher:	**Shards Software**
Machine:	**BBC Model B**
Price:	**£6.95**

Monster Maths is a cassette of programs in Sharp's 'Fun to Learn' Series intended to help develop basic mathematical and logical skills of 8-14 year olds.

The program, which takes over four minutes to load from tape, is menu driven and this permits the user to change level difficulty, user's name and printing speed. On-screen instructions, printed in double-height letters, are easy to follow perhaps a rather 'busy' menu page. This menu facility is very useful one for cassette-based programs, particularly if they are closely linked, and gives the busy class teacher the chance to load a 'suite' of programs at the beginning of a session and enables them to change programs for individuals or small groups at the touch of the ESCAPE key, which takes the user back to the Main page.

Having set the level of difficulty (1-9), the user is asked to "Press the key shown to play 'the game' "

a. *Rectangles*. 'Do you want an easy one?' What happened to the level of difficulty set at the menu page? The user is asked to guess how many times the large shape is bigger than the small shape and points are scored according to level of difficulty.

b. *Monster Maths*. A frantic 'spider' moves around the screen. Get three sums right in 30 seconds or be eaten by the monster e.g.

Level 5 $15-15$, 27×22, $187+62$
9 63×18, $1581-51$, $1165-847$!

c. *Times Tables*. Practice your tables. Would you like to know your − 999 times table? You can use this program.

d. *Arithmetic*. The four rules of number — see any arithmetic text book.

e. *Mystery Number*. In this program the user is given a mystery number and asked how the computer used a given set of numbers and signs (+, −, ×) to make up that number. e.g. Level 2 — Mystery number 1368 from 18, 3, 4, 16 — use *all* numbers. Level 9 — Mystery Number 2297 from 11 given numbers!

Praise for this cassette ends with the menu. Games? Fun to Learn? Somebody has a strange idea. The structured reinforcement (drill and practice) type of program has a place in computer assisted learning, but this must be with far less mundane material than that presented in Monster Maths. Shards should realise that a school cannot afford to tie up its computer for lengthy periods while it displays a task which can be seen in many text books and on bands sheets — and usually with far greater structure! Certainly not one for my collection.

Ratings Table

SOUND	20%
GRAPHICS	30%
DOCUMENTATION	40%
VALUE FOR MONEY	30%
EDUCATIONAL	20%
OVERALL	40%

Title:	**Views/Faces**
Publisher:	**Primary Programs**
Machine:	**Model B**
Price:	**£3.95**

Views is the most impressive of these two straightforward programs. It is impressive in its simplicity. There are three clear and colourful pictures defined within the programs, one of a house, one of a tree and one of a lampost. The three drawing routines are accessed by the child and only the size need be specified.

In other words a picture can be drawn by simply making two choices; H or T or L for the type; and a figure denoting size. If that is not simple enough then you can even turn on the auto-size option. Result: an instant housing estate, wood, road side, play area and so on. The young child as town planner.

As well as having fun creating the scene, the program also helps teach how to go about constructing the picture. The most recent addition to the picture always overdraws, so that it is necessary for a child to plan the construction of the picture in order to get the perspective right. This is art rather than property development.

Faces offers various choices of salient facial features which can be positioned upon the blank outline provided. The actual drawing and colouration is not as realistic as some similar programs but there is careful prompting and error trapping.

Ratings Table

SOUND	N/A
GRAPHICS	85%
DOCUMENTATION	75%
VALUE FOR MONEY	90%
OVERALL	85%

A Question of Printers

Mark Webb

The exceptional ability of the BBC at 'talking' to peripherals has made a range of printers available to the BBC user. We look at three of them, including the HAL FT-5001.

The intention here is to take a look at the HAL Computers FT-5001 and to compare it with a couple of near rivals, the Epson FX80 and the Mannesman Tally.

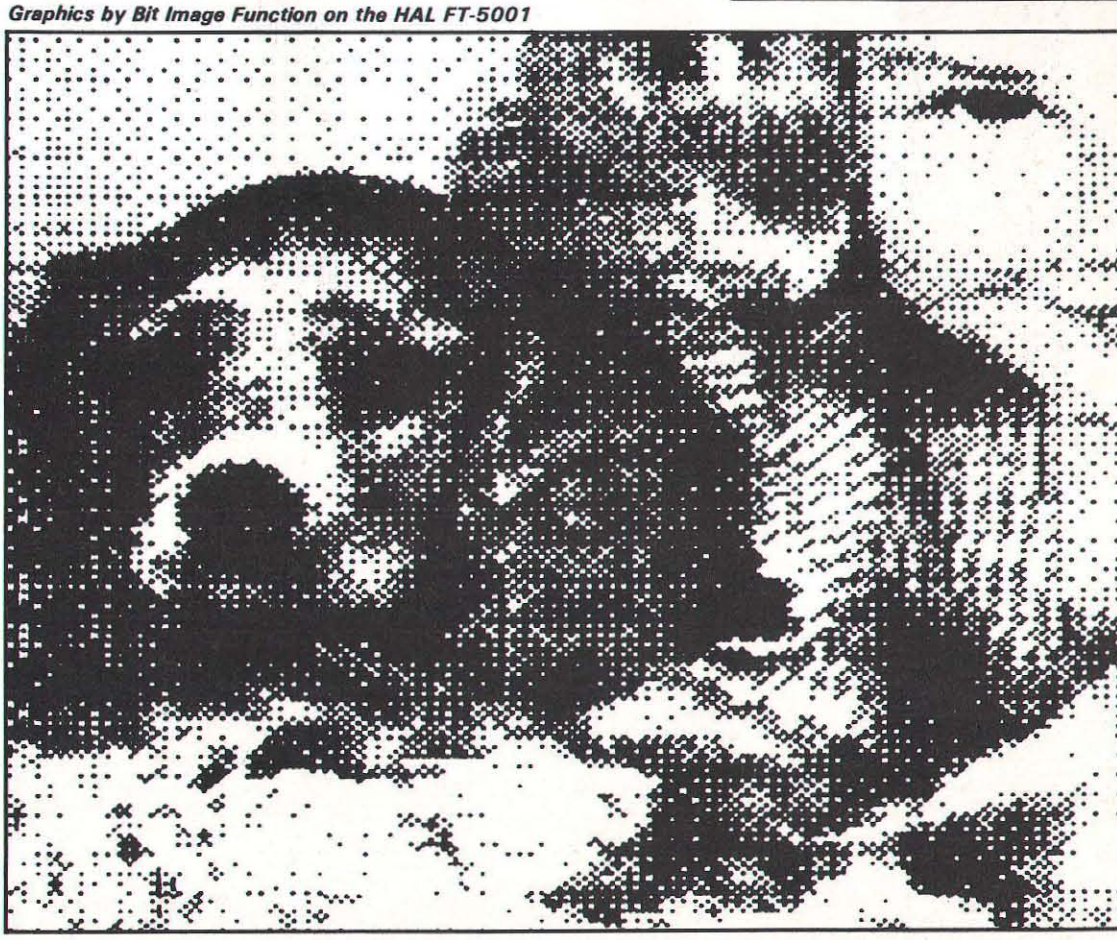
These latter printers are near rivals both in price and performance. The FX80 is available at around the £370 mark and the Mannesmann Tally MT80 at £285. You can add an RS 232 interface to this printer for an extra £50. The FT-5001 is currently available or £289 and offers considerable value for money when we look at its specifications.

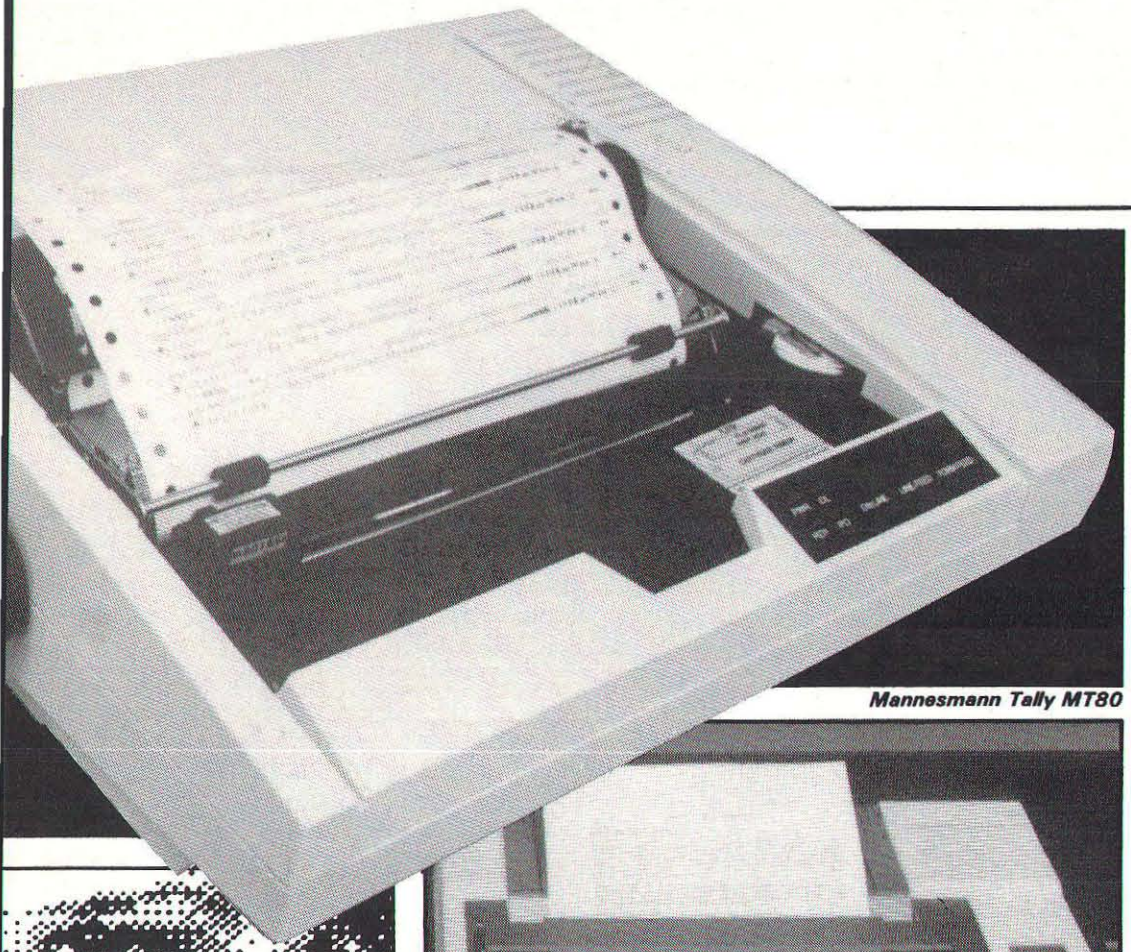
The features of the FT-5001 are strikingly similar to the Epson range. In fact the printer uses the same impact serial wire dot matrix printing system. What a mouthful. Simply, it uses the same parts. Neither is appearance dissimilar with power, on-line and out of paper indicators. There are also form and line feed switches, an on-line switch and a power switch (on the right side, not the left as on the FX80). The MT80 is somewhat different in style and would look fine on an executive's desk with its sleak smoked glass top. This large top also has the effect of damping down sound and reducing the usual rasp of the dot matrix print head. None of the three printers here reviewed was particularly noisy.

PRINT STYLE

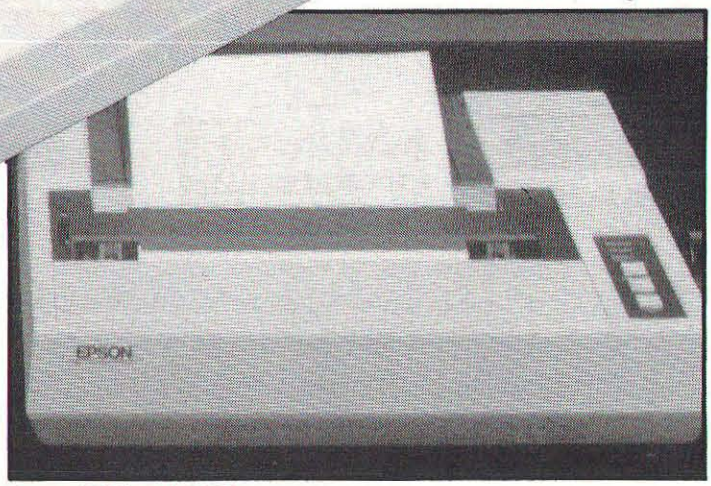
The FT-5001 has all the impressive printing styles which we have come to expect from the Epson machines, including character sets for eight different countries, characters with pica and elite pitch plus various condensed and emphasised modes. The super and subscript facility is also available and in my experience, is a useful one to have. A separate programming manual which comes with the printer, explains all the different types of print, character widths, tabulations and line spacing. It remains up to the Beeb owner to place the documented Escape codes into the appropriate VDU commands in the form VDU 1, 27, 1, 69 — emphasised mode or VDU 1, 27, 1, 52 — italic font setting. The Epson printers now have a manual available which lists the

Graphics by Bit Image Function on the HAL FT-5001

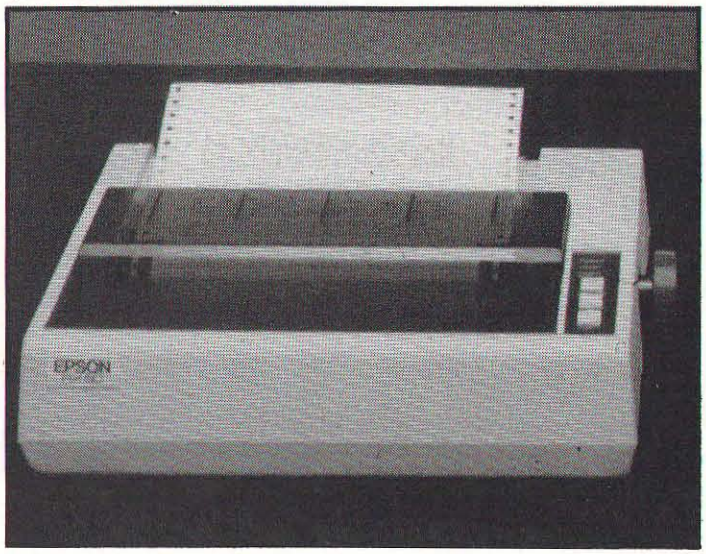




Mannesmann Tally MT80



Epson RX80 and FX80



most common VDU commands needed by a Beeb user.

The FT-5001 manual is particularly good on setting up and operation, with plenty of clear diagrams and labels for each stage of the process. The Mannesman Tally printer too has a good instruction manual with its oriental origins carefully camouflaged. The manual comes into its own when it comes to setting the DIP switches (which involves taking the whole machine apart). It's a bit easier with the HAL FT-5001 since the switches are accessed through a small rectangular hole in the rear centre of the printer (on the bottom). The switches set printing modes, character sets, page length and, especially useful, a skip perforation mode. This allows a three line leeway on each printed sheet either side of a perforation.

The FT-5001 and the MT80 can use Z-fold paper with perforations or letter paper. Paper feed can be by tractor or friction. This is set on the HAL with a switch on the left hand side of the printer. The manual states that the FT-5001 can accomodate 80 printed characters with the pica pitch per line with a printing speed of 80 characters a second. I have seen some literature however which has claimed 100 characters per second. The speed is perfectly acceptable however and as with the MT80 and FX80, efficiency is increased by bidirectional printing.

The ribbon cartridges used on all the printers are easily installed. The MT80 is the exception in having coated tape rather than inked cloth ribbon.

All three printers here reviewed are entirely suitable for the home or business user who wants to buy a printer to enhance the existing BBC system. The Epson RX and FX80 printers are established in the marketplace and there are some software advantages in buying Epson. However the MT80 from Mannesman Tally and the FT-5001 from HAL computers are excellent alternatives, at getting on for £100 cheaper than the FX80. The FT-5001 offers an especially good range of printing options for the price.

Software Listings

Want a program for your BBC Micro. Look no further than our listings to make your choice.

Finding and choosing the correct software for your needs is a daunting task indeed, whether you are looking for a word processing package or for a new game to test your alien-destroying, treasure-seeking, path-finding talents!

Often you can be put off even looking through the pages of advertisements which tempt you with vivid descriptions of the amazing graphics and sound effects of the game being offered, you sit there with pen poised above cheque book and your eye catches the small print that tells you that the game will run on just about every available machine except the one sitting beside you!

But BBC Micro owners despair no longer — help is at hand in the following pages. We have put together as comprehensive a list as possible of the software available for the BBC Micro. In order to fit in as many as possible we have had to use codes in some columns. The title of the software, the memory required to run it, the company that produces it, whether it is tape/cartridge or disc, the supplier and the price, are given for each piece of software listed. The codes used are:

Code	Explanation
Gm	Game
Bs	Business Routine
Ut	Utility (ie programming aid)
Do	Domestic
Ed	Educational
C	Cassette

As you are probably aware new software is surfacing all the time so don't assume that there is no such item as the one you are looking for if it is not included in this list. Also, remember that games in particular that at present run only on a machine other than the BBC Micro may well soon appear in a BBC version. If you are aware of a piece of software that is not listed here, whether you are a user or a producer, feel free to let us know.

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
ABC	Ed	Bryants	32K	C	HW	£4.85
Abductor	Gm	Salamander	16K	C	NZ	£7.95
ABM	Gm	Alligata	16K	C	AG	£4.95
Action of the Heart	Ed	Garland Comp.	32K	C	JX	£11.76
Accounting Ratios	Bs	Microplex	32K	C	MP	£7.95
Accounts Receivable	Bs	Acornsoft	32K	D	AL	£24.95
Accounts Payable	Bs	Acornsoft	32K	D	AL	£24.95
Add Tabs and Mul-Tabs	Ed	Cottage Soft	16K	C	CT	£7.50
Ade	Ut	System	32K	C	SY	£60.00
Adventure	Gm	Program Power	16K	C	GK	£7.95
Adventure 1	Gm	Odyssey	32K	C	OG	£4.50
Adventure 2	Gm	Odyssey	32K	C	OG	£4.50
Adventure	Gm	Micro Power	32K	C	GK	£6.95
Adventure	GM	Program Direct	32K	C	NP	£5.99
Adventure Quest	Gm	Level 9 Computing	32K	C	CU	£9.90
Airline	Gm	Cases	16K	C	CE	£6.95
Algebraic Manipulation	Ut	Acornsoft	16K	C	AL,GA	£9.95
Alien	Gm	FBC	16K	C	FB	£6.00
Alien Destroyers	Gm	Program Power	32K	C	GK	£7.95
Alienswirl	Gm	Amcom	32K	C	AO	£5.95
Alien Swirl	Gm	Program Power	32K	C	GK	£6.95
Alien Destroyers	Gm	Micro Power	32K	C	GK	£6.95
Airlift	Gm	Bug Byte	32K	C	KP	£5.50
Android Attack	Gm	Computer Concepts	32K	C	GJ	£7.80
Anagram	Ed	Ed.Soft	32K	C	ES	£4.95
Angles Navigate	Ed	Primary Programs	32K	C	PP	£3.95
Angle(4)	Ed	Chalksoft	32K	C	KT	£6.95
Anglezap	Gm	Gem	32K	C	GM	£7.50
Animal/Vegetable/Mineral	Ed	Bourne	32K	C	BO	£8.97
Apollo	Gm	Software Invasion	32K	C	IS	£6.95
Append It	Ut	Aztec S/W	16K	C	IB	£3.00
Alien Dropout	Gm	Superior Software	32K	C	SE	£7.95
All Fingers Go	Ed	NEC	16K	C	NC	£14.95
Alpha	Ed	Golem	32K	C	OB	£8.05
Alphachopper	Ed	Sulis	32K	C	SU	£9.95
Alphabet	Ed	J B Software	32K	C	JS	£4.95
Alphabeta	Bs	H and H Software	32K	C	HH	£28.50
Android Attack	Gm	Computer Concepts	32K	C	GJ	£8.95
Animated Arithmetic	Ed	Ludinski CAL	16K	C/D	KA	£6.50/ £7.50
Apocalypse	Gm	Red Shift	32K	C	RS	£9.95
Arcadians	Gm	Acornsoft	32K	C	AL	£9.95
Arcade Action	Gm	Acornsoft	16K	C	GA	£11.90
Arcade 1	Gm	Odyssey	32K	C	OG	£3.00
Arcade Games	Gm	Ganymede Systems	32K	C	GY	£9.95
Area Radar Controller	Gm	Software For All	32K	C	KN	£6.95
Arrow of Death (1)	Gm	Digital Fantasia	16K	C	IT	£6.95
Arrow of Death (2)	Gm	Digital Fantasia	16K	C	NT	£8.95
Asteroid Storm	Gm	Program Power	32K	C	GK	£7.95
Asteroids/Frong	Gm	Aardvark Software	16K	C	IU	£4.00
Asteroid Belt	Gm	Electronics Appplied	32K	C	IF	£11.50
Asteroid Belt	Gm	Computer Concepts	16K	C	GJ	£7.80
Asteroid Miner	Gm	Optima	32K	C	OP	£8.95
Astro Navigator	Gm	Micro Power	32K	C	GK, NR	£6.95
Atlantis	Gm	IJK Software	32K	C	IT	£6.95
Atomic Protector	Gm	Optima	32K	C	OP	£8.95
Awari	Gm	Foilkade	16K	C	NR	£5.95
Backgammon	Ut	Bug Byte	32K	C	EA,KP	£8.00
Bailiff	Ed	Sulis	32K	C	SU	£9.95
Ballard	Ed	Ed.Soft	32K	C	ES	£3.00
Balloons	Gm	C J E Microcomputers	32K	C	NV	£6.00
Bandits at 3 O'Clock	Gm	Program Power	32K	C	GK	£6.95
Barrage	Ed	Program Power	32K	C	GK	£7.95
Basic Goodies	Ut	Simonsoft	16K	C	MS	£5.95
Basic Maths	Ed	Aztec S/W	16K	C	IB	£3.00
Basic Statistics	Bs	Micropak	32K	C	MP	£7.95
Battlefield	Gm	Micro-Aid	32K	C	IZ	£2.50
Battlezone Six	Gm	Kansas	32K	C	KA	£9.50
Battlezone 2000	Gm	Lothlorien	32K	C	LO	£6.95

SOFTWARE SUPPLIERS

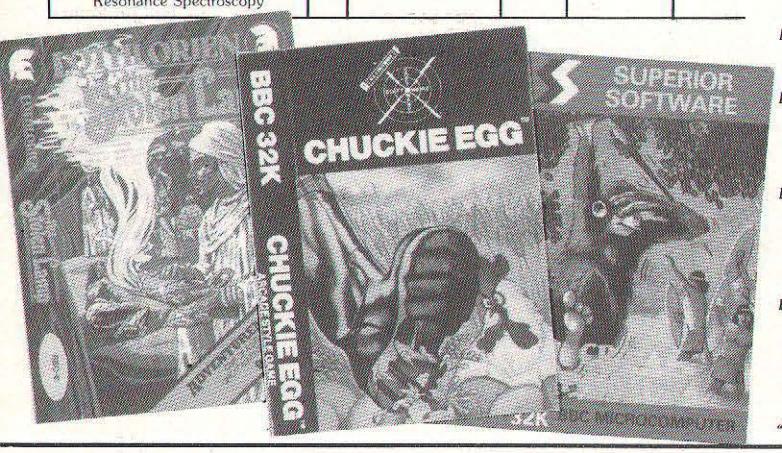
Supplier Code	
AA	Anthony Aspitel Software Systems 56 London Road Harleston Norfolk IP20 9BZ
AB	ABC Primary 19 Crumstone Court Longmeadow Estate Killingworth Newcastle Upon Tyne
AD	Dial Software 72 Downend Road Downend Bristol
AG	Superior Systems Ltd 178 West Street Sheffield WS1 4ET
AJ	Molimerx Ltd 1 Buckhurst Road Town Hall Square Bexhill-on-sea East Sussex
AL	Acornsoft Ltd 4a Market Hill Cambridge CB2 3NJ
AM	Microplus Software 6 Litton Way Leeds
AO	Amcom 23 Hivings Hill Chesham Bucks HP5 2PG
AP	Processor Applications 22 Mercer Close Basingstoke Hants
AK	A.S.K. Ltd London House 68 Upper Richmond Road London Sw15 2RP
AS	ASD Ltd 30 West End Launton Bicester Oxon
AV	A J Vision Service Ltd 61 Jeddo Road London W12 9ED
BB	Bug-Byte Mulberry House Canning Place Liverpool L1 8JB
BE	Beebug P.O. Box 50 St. Albans Herts AL1 2AR
BK	BAKsoft 34 Humberstone Road Cambridge
BO	Bourne Educational Software Headbourne Worthy Winchester Hants SO23 7SQ
BU	Busco 16 Colwill Walk Mainstone Plymouth
CA	Carvells 3/7 Bank Street Rugby
CR	Carswell Computers Carswell Barn Faringdon Oxon SN7 8JN
CD	Carsondale Enterprises Ltd 44 Kingsway Stoke-on-Trent Staffordshire ST4 1JH
CG	Challenge Games 64 Ferndale Road London E11
CH	Chalksoft Ltd 37 Willowslea Road Worchester WR3 7QP
CS	Stable Software Compton Street Compton Nr Winchester Hants
CT	Cottage Software Heather Cottage Selly Hill Whitby North Yorkshire
CU	Level 9 Computing 229 Hughenden Road High Wycombe Buckinghamshire HP13 5PG
CX	Contex Computing 15 Woodlands Close Cople Bedford MK44 3UE
DC	D.A.C.C. Ltd 23 Waverly Road Hindley Greater Manchester WN2 3BN
DK	DK Tronics Unit 2 Shire Hill Industrial Estate Saffron Walden Essex CB11 3AX
DG	Dialog 19 Short's Gardens London WC2H 9AT
DO	Doctor Soft 258 Coneygree Road Peterborough PE2 8LR
DS	Diamondsoft Ltd Cheadle Hulme Cheadle Cheshire SK8 5YB
EB	Ebury Software National Magazine House 72 Broadwick Street London W1V 2BP
EH	Heinemann Computers in Education 22 Bedford Square London
EJ	Logic Systems 85 Hemingford Road Cambridge
EL	ECL Software 29 Richmond Close Ware Herts SG12 0EN
ET	Etna Software West End House West End Lane Marshchapel Lincs
EU	Educare 139a Sloane Street London SW1X 9AY

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
Beebart	Ut	Quicksilva	32K	C	QS	£14.95
Banner	Do	Micro-Aid	16K	C	IZ	£2.95
Beeb-Chase	Gm	Database Software	32K	C	NU	£7.50
Beebmunch	Gm	I.J.K. S/W	32K	C	IT	£5.95
Beebtrek	Gm	Software for All	16K	C	KN	£7.95
BEEP-BEEB	Gm	IJK	32K	C	IT	£3.95
Beep-Beeb (Super Simon)	Gm	IJK Software	32K	C	IJ	£4.50
Beebcalc	Bs	Gemini	32K	C	GM	£19.95
Beebmon	Ut	Program Power	16K	C	GK	£7.95
Beebplot	Bs	Gemini	32K	C	GM	£19.95
Beeboids	Gm	Odyssey	16K	C	OG	£2.75
Beebon Mon	Ut	McKeran	16K	C	MK	£2.00
Beebsynth	Ut	Clares	16K	C	CL	£7.95
Beeb-Tote	Gm	Program Power	32K	C	GK	£5.95
Beefeater	Ed	Sulis	32K	C	SU	£7.95
Besieged	Ed	Sulis	32K	C	SU	£9.95
Beyond Basic	Ed	BBC/NEC	16K	C	KB	£7.25
Billiards	Gm	H and H Software	32K	C	HH	£8.50
Blackjack/Textpro	Gm /Ut	Software Invasion	32K	C	IS	£6.95
Bomb Alley	Gm	Software Invasion	32K	C	IS	£7.95
Bomber Scramble	Gm	Kansas	32K	C	KA	£9.50
Bounce	Gm	Computercat	16K	C	CC	£4.95
Bouncers	Gm	A&F	32K	C	GE	£8.00
Bounty Pirates	Gm	Aztec S/W	16K	C	IB	£5.50
Break-Up	Gm	Miking S/W	32K	C	KC	£3.95
Breakout	Gm	I.J.K. S/W	16K	C	IT	£3.95
Breakout	Gm	Bryants S/W	32K	C	HW	£3.75
Brick 'em in	Gm	Software For All	32K	C	KN	£6.95
Bridge to the East	Gm	Ixion	32K	C	IN	£8.05
Bridgeman	Gm	Bridge S/W	32K	C	KJ	£7.90
Budget	Bs	Micropax	32K	C	MP	£7.95
Budget-Multiproduct	Bs	Micropax	32K	C	MP	£12.95
Budget-Multiproduct	Bs	Micropax	32K	D	MP	£25.00
Bug Bomb	Gm	Virgin Games	32K	C	VG	£7.95
Business Game	Ed	Acornsoft	16K	C	AL	£9.95
Bun Fun	Gm	Squirrel Software	32K	C	SS	£6.50
Canyon	Gm	BBC Pubs	32K	C	KB	£10.00
Capitals and Punctuation	Ed	RJE Software	16K	C	RJ	£4.95
Carbohydrate Metabolism	Ed	Garland Comp.	32K	C	JX	£18.24
Cards	Gm	Micro Aid	16K	C	IZ	£2.95
Carousel	Gm	Acornsoft	32K	C	AL	£9.95
Car Race	Gm	Kingfisher	32K	C	KF	£6.90
Cashbook Accounts	Bs	Gemini	32K	C	GM	£59.95
Cashbook	Do	Micro-Aid	32K	C	IZ	£5.95
Cashbook B	Do	Micro-aid	16K	C	IZ	£3.95
Cassette 99	Ed	Ludinski CAL	16K	C	KA	£5.00
Castle of Riddles	Gm	Acornsoft	32K	C	AL	£9.95
Catalog	Bs	Dialog	32K	C/D	DG	£19.50
Catalogue	Ut	Baksoft	16K	C	BK	£4.00
Cat and Mouse	Ed	Kingfisher	16K	C	KF	£6.90
Cat & Mouse	Gm	Micro Power	16K	C	GK	£4.95
Catchapple	Ed	Kingfisher	16K	C	KF	£6.90
Caveman Adventure	Gm	Program Power	32K	C	GK	£6.95
Caves of Anoran	Gm	FBC Systems	32K	C	FB	£7.00
Cells and Serpents/ Stockmarket	Gm	ASP Software	16K	C	OD	£11.45
Cells & Serpent	Gm	Hexagon S/W	16K	C	JA	£5.00
Centipede	Gm	Superior S/W	32K	C	KH	£7.00
CESCIL	Ed	Eduquest	16K	C	NW	£19.95
Centpede	Gm	Superior Software	32K	C	SE	£7.95
Cesil Interpreter	Ed	Computersmith	32K	C	LC	£15.00
Challenger	Gm	Joe the Liar	32K	C	JL	£7.45
Character Formatter	Ut	BBC	16K	C	KB	£3.00
Character Shapemaker	Ut	Square	32K	C	SQ	£7.00
Chargen	Ut	Busco	16K	C	BU	£3.95
Chargen and Demo	Ut	Rainbow Research	32K	C	RR	£8.50
Character Builder	Ut	Davensoft	16K	C	NX	£4.95
Characters	Ut	Computer	32K	C	GJ	£6.67
Character Enlarger	Ut	Ratco Soft	16K	RA	£1.50	
Character Orientating	Ut	Ratco Soft Concepts	16K	C	RA	£1.50
Character Generator	Ut	MP S/W	32K	C	JZ	£3.00
Character Generator	Ut	Software for All	32K	C	KN	£4.95
Characters	Ut	Computer Concepts	16K	C	GJ	£6.67
Characters & Envelope Definer	Ut	Electronics Applied	32K	C	IF	£5.50
Chard	Ut	System	32K	C	St	£9.00
Chargen	Ut	Odyssey	16K	C	OG	£4.50
Chemical Analysis	Ed	Acornsoft	32K	C	AL, GA	£13.80
Chemical Simulations	Ed	Acornoft	32K	C	AL, GA	£13.80
Chemical Structures	Ed	Acornsoft	32K	C	AL, GA	£13.80
Chemistry	Ed	Program Power	32K	C	GK	£6.95
Chess	Gm	Program Power	16K	C	GK	£5.95
Chess	Gm	Program Power	32K	C	GK	£7.95
Chess	Gm	Acornsoft	32K	C	AL, GA	£9.95
Chess	Gm	Bug Byte	32K	C	EA	£11.50
Chess	Gm	Micro Power	32K	C	GK	£6.95
Children From Space	Ed	A.S.K.	32K	AK	£9.95	
CHI-Squared	Bs	Micropax	32K	C	MP	£7.95
CHI-Squared, contingency tables	Bs	Micropax	32K	C	MP	£7.95
Chords	Ed	Aztec	16K	C	AZ	£6.50
Circus	Gm	Digital Fantasia	32K	C	NT	£8.95
City Defense	Gm	Bug-BYte	32K	C	BB	£7.50
Claws	Ed	Bryants S/W	16K	C	HW	£3.75
Clone Ranger	Ut	J.C. Software	32K	D	JS	£11.60
Cloze	Ed	GED Software	32K	C	GD	£4.50
Cloze Procedure	Ed	Bryants S/W	16K	C	HW	£4.85
Cards	Gm	Micro-Aid	16K	C	IZ	£2.95
Cobra/Robo-Swamp	Gm	Software for All	16K	C	KN	£6.95
Cobra/Robo-Swamp	Gm	Software for All	32K	C	KN	£6.95
Code Breaker	Gm	Program Power	16K	C	GK	£4.95
Code-Breaker	Ed	RJE Software	16K	C	RJ	£4.95
Collectors Catalogue	Do	Acornsoft	32K	C	AL	£9.95
Code Race	Gm	Computer Concepts	16K	C	GJ	£6.67
Code Race	Ut	Computer Concepts	32K	C	GJ	£6.67
Colditz Adventure	Gm	Superior Software	32K	C	SE	£7.95
Colossal Adventure	Gm	Level 9 Computing	32K	C	CU	£9.90
Comatch	Ed	Clares	16K	C	CL	£4.95
Commercial Accounts	Bs	Gemini	32K	C	GM	£19.95
Community	Gm	Ixion	32K	C	IN	£6.90
Compass	Ed	GED Software	32K	C	GD	£4.50
Compendium	Gm	Computercat	32K	C	CC	£5.95
Connect 4	Gm	Database Software	32K	C	NU	£5.90
Constellation	Ed	Program Power	32K	C	GK	£6.95
Contribution Analysis	BS	Micropax	32K	C	MP	£7.95
Cookbook Wizardry	Do	Database Software	32K	C	NU	£7.50
Corn Cropper	Gm	Cases	16K	C	CE	£6.95
Cosmic Asteroids	Gm	Alligata	32K	C	AG	£4.95
Cosmic Fighters	Gm	Kansas	32K	C	KA	£9.50
Coucapcur	Ed	Ed. Soft	32K	C	ES	£4.95
Countdown to Doom	Gm	Acornsoft	32K	C	AL, GA	£9.95
Counting	Ed	Clares	16K	C	CL	£4.95
County (SW/SM)	Ed	Bryants	16K	C	HW	£4.85
Cowboy Shoot-out	Gm	Micro Power	32K	C	GK	£5.95
Cranky	Ed	A.S.K.	32K	C	AK	£9.95
Crazy Painter	Gm	Superior Software	32K	C	SE	£7.95
Creative Graphics	Ut	Acornsoft	32K	C	AL,GA	£9.95
Cricket	Gm	SJG Soft	32K	C	SJ	£7.50
Crime and Detection Quiz	Do	Acornsoft	32K	C	AL	£12.65

Croaker	Gm	Program Power	32K	C	GK	£9.95
Crocodiles	Ed	Bryants	16K	C	HW	£4.85
Crossed Words	Ed	Aztec S/W	16K	C	IB	£6.50
Crunch	Ed	Oxhey Tutors	32K	C	OT	£6.50
C. Rules	Ed	Ed. Soft	32K	C	ES	£5.95
Cube Master	Gm	Acornsoft	32K	C/AL	£9.95	
Curse of the Middle	Gm	Merlin	32K	C	MN	£7.95
Cylon Attack	Gm	A&F	32K	C	GE	£8.00
Dallas	Gm	Cases	16K	C	CE	£6.95
Danger! UXB	Gm	Program Power	32K	C	GK	£7.95
Dare Devil Dennis	Gm	Visions	32K	C	VI	£7.95
Database	Ut	Computercat	32K	C	CC	£12.95
Database	Bs	Gemini	32K	C	GM	£19.95
Data-Quiz	Ut	Bryants S/W	32K	C	HW	£4.88
Database	Ut	R. H. Electronics	32K	C	RH	£12.95
Database	Bs	Acornsoft	32K	C	AL	£11.90
Database	Ed	Ed. Soft	32K	C	ES	£19.95
Database	Bs	Primasoft	32K	C	CT	£9.95
Database	Bs	Computercat	16K	C	IJ	£11.95
Database	Bs	Software for All	16K	C	KN	£9.95
Data File	Do	Kansas	32K	C	KA	£12.50
Dataxt	Ut	Optima	32K	C	OP	£9.95
Dating Game	Do	Acornsoft	32K	C	AL	£12.65
Defchr	Ut	Micro-Aid	16K	C	IZ	£2.95
Demon Decorator	Gm	Program Power	32K	C	GK	£6.95
Density and Circuit	Ed	Acornsoft	16K	C		£11.90
Descender	Gm	FBC Systems	32K	C	FB	£7.50
Desk Diary	Bs	Acornsoft	16K	C	AL	£9.95
Detective	Gm	Computersmith	32K	C	LC	£5.50
Devil's Causeway	Gm	Anirog Computers	16K	C	0A	£6.00
DFM Database	Bs	Dialog	32K	C/D	DG	£24.00
DFM Mail Labels	Bs	Dialog	32K	C/D	DG	£10.00
Dictator	Gm	D. K. Tronics	32K	C	DK	£6.95
Disassembler	Ut	Simonsoft	16K	C	MS	£6.95
Dissassembler	Ut	Micro Power	16K	C	GK	£5.95
Dissassembler	Ut	Program Direct	16K	C	NP	£3.00
Dissassembler	Ut	Davansoft	16K	C	NX	£5.95
Dissassembler	Ut	C J E Microcomputers	16K	C	NV	£5.00
Distances	Ed	Micro-Aid	32K	C	IZ	£3.95
Dissembler	Ut	Rainbow S/W	16K	C	KS	£2.50
Digital X-Word Compiler	Gm	N. Darwood	16K	C	JB	£6.00
Dmon	Ut	Alligata	16K	C	AG	£7.95
Dmove	Ut	FBC Systems	32K	C	FB	£12.50
DNA Replication	Ed	Garland Comp.	32K	C	JX	£17.65
Dracula Island	Gm	Kansas	32K	C	KA	£9.50
Dragon Rider	Gm	Salamander Software	32K	C	NZ	£7.95
Dragon Quest II	Gm	Bug Byte	32K	C	KP	£11.50
Dragon Quest	Gm	Bug Byte	32K	C	KP	£11.50
Draughts/Reversi	Gm	Acornsoft	32K	C	AL, GA	£9.95
Draw	Ut	Program Power	32K	C	GK	£9.95
Drawing	Ut	B.B.C.	16K	C	KB	£10.00
Dr. Who: The First Adventure	Gm	BBC Pubs	32K	C	KB	£10.00
Dungeon Adventure	Gm	Level 9 Computing	32K	C	CU	£9.90
Dynamic Nuclear Magnetic Resonance Spectroscopy	Ed	Microwave	32K	C	MW	£3.95



SOFTWARE SUPPLIERS

FB FBC Systems, 10 Castlefields, Main Centre, Derby

FM 4MAT Educational Software, Linden Lea, Rock Park, Barnstaple, Devon EX32 9AQ

FY Wida Software, 2 Nicholas Gardens, London W5 5HY

GC Gem Software, Unit D, The Maltings, Station Road, Sawbridgeworth, Herts

GD 70 Stoke Road, Bletchley, Milton Keynes

GE A&F Software, 83 Hyde Road, Gorton, Manchester M18 7JD

GJ Computer Concepts, 16 Wayside, Chipperfield, Hertfordshire WD4 9JJ

GK Micro Power Ltd, 8/8a Regent Street, Chapel Allerton, Leeds LS7 4PE

GM Gemini, 9 Salterton Road, Exmouth, Devon EX8 2BR

GS Gaelsett Software, 44 Exeter Close, Stevenage, Herts, SG1 4PW

GY Huntsman Walk, Rugeley, Staffs WS15 2SN

HC H.C.C.S. Associates, 533 Durham Road, Low Fell, Gateshead, Tyne and Wear NE9 5EY

HG J Hargreaves, Updown, Pewley Way, Guildford, Surrey

HN Hutchinson, 17-21 Conway Road, London W1P 6JD

HW Bryants (Educational) Software, 1 The Hollies, Chalcraft Lane, North Bersted, Bognor Regis PO21 5SX

HX Hexagon Software, 17 Straits Road, Gornal, Dudley, West Midlands, DY3 2UR

IB Aztec Software, 25 St Mark Road, Deepcar, Sheffield, S30 5TS

IC Ian Copestake, 23 Connaught Crescent, Brookwood, Woking, Surrey, GU24 0AN

IF Electronics Applied, 4 Dromore Road, Carrickfergus, County Antrim BT38 7PJ

IJ I J K Software, 9 King Street, Blackpool, Lancs

IN Ixion Software, 10 The Crescent, Lympsham, Weston-Super-Mare, Somerset BS24 0BN

IS Software Invasion, 50 Elborough Street, Southfields, London

IT IJK Software, 55 Fitzroy Road, Bispham, Blackpool

IU Aardvark Software, 15 Queensberry Avenue, Hartlepool, Cleveland TS26 9NW

IV James Hager, 7 Basset Street, Camborne, Cornwall TR14 8SW

IW Simon Hessel Software, 15 Lytham Court, Cardwell Crescent, Bershire

IX Mayday Software, 181 Portland Crescent, Stanmore, Middlesex HA7 1LR

IY Persoft, Freepost, Baildon, Shipley, West Yorkshire BD17 5SX

IZ Micro Aid, 25 Fore Street, Praze Camborne, Cornwall TR14 0JX

JL Joe the Lion, 213/215 Market Street, Hyde, Cheshire, SK14 1HF

JS J.B. Software, 57 Meadow Crescent, Carleton, Poulton-le Fylde, Lancashire, FY6 7QX

JA Hexagon Software, 17 Cambridge Grove, Otley

JB N Darwood Ltd, Halfacres, Stroud, Peterafield, Hampshire GU32 3PJ

JC Futura Software, 63 Lady Lane, Chelmsford, Essex CM2 OTQ

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
Early Learning	Ed	B.B.C.	16K	C	KB	£10.00
Early Numbers	Ed	Bryants S/W	32K	C	HW	£4.80
Early Warning	Gm	A&F Software	16K	C	GE	£6.00
Easycalc	Bs	Zero Software	32K	C	AZ	£12.95
Easy Graphics	Ut	Hexagon Software	32K	C	HX	£13.50
Easywrite	Ed	System Software	32K	C	SY	£10.00
Ecological Simulations	Ed	Garland	32K	C	JX	£16.50
E.D.G. Graphics Package	Ut	Salamander	32K	SA	£19.95	
Ed-master	Ed	R. H. Electronics	32K	C	RH	£12.95
Educare's 50	Ed	Educare	16K	C	EU	£7.95
Education (1)	Ed	Microplus	16K	C	AM	£4.25
Educational (1)	Ed	Golem	16K	C	OB	£8.00
Educational (2)	Ed	Microplus	16K	C	AM	£5.25
Educational (2)	Ed	Golem	16K	C	OB	£8.00
Education (3)	Ed	Microplus	32K	C	AM	£5.25
7 Educational Games	Gm	Micromail	32K	C	OE	£5.75
Eiffel Tower	Ed	Chalksoft	32K	C	CH	£9.25
Eldorado Gold	Gm	Program Power	32K	C	GK	£6.95
Electric	Ed	Database Software	16K	C	NU	£5.50
Electricity	Ed	Primary Programs	32K	C	PP	£3.95
Elem-add and Elem-sub	Ed	Cottage Soft	32K	C	CT	£7.50
Envelope Generator	Ut	System	32K	C	SY	£7.00
Equation Balance	Ed	RJE Software	32K	C	RJ	£7.95
Escape From Moonbase Alpha	Gm	Program Power	32K	C	GK	£7.95
Essential French Verbs	Ed	Carsondale	32K	C	CD	£11.50
European Studies	Ed	Aztec S/W	32K	C	IB	£6.50
Escape from Pulsar 7	Gm	Digital Fantasia	32K	C	NT	£8.95
Exman	Ut	Beebug	32K	CE	BB	£10.00. £23.00
Extended Colour Fill Graphics	Ed	Gaelsett Software	32K	C	GS	£10.00
Experiments in Artifical Intelligence	Ed	Ganymede Systems	32K	C	GY	£9.95
Eye	Ed	Longman	32K	C	LM	£14.50
Facemaker	Ed	A.S.K.	32K	C	Ak	£9.95
Factfile	Ed	CUP	32K	C	UP	£18
Family Games	Gm	I.J.K. Software	16K	C	IJ	£4.50
Fairground	Gm	Superior Software	32K	C	SE	£7.95
Fairytale	Gm	Molimerx	32K	C	AJ	£10.06
Feasibility Experiment	Gm	Digital Fantasia	32K	C	NT	£10.29
Female Reproductive Cycle	Ed	Garland	32K	C	JX	£12.00
Felix and the Fruit Monsters	Gm	Program Power	32K	C	GK	£7.95
Felix In The Factory	Gm	Program Power	32K	C	GK	£7.95
F For Freddie	Gm	Kansas	32K	C	KA	£9.50
Fighter Pilot	Gm	Kansas	32K	C	KA	£9.50
Filer	Bs	Micro Power	16K	C	GK	£8.95
Final Accounts Program	Bs	Gemini	32K	C/D	GM	£59.95
First Steps in Algebra	Ed	Small School	32K	C	SM	£6.95
Firien Wood	Gm	MP S/W	32K	C	JZ	£6.50
FIZZ BUZZ	Ed	G.E.D. Software	32K	C	GD	£4.50
Fizz Buzz	Ed	Bourne	16K	C	B	£4.50
Flags	Ed	IJK Software	32K	C	IJ	£4.50
Flags	Ed	Micro-Aid	32K	C	IZ	£3.95
Flanders	Ed	Focusplan	16K	C	FP	£5.95
Flexibase	Dm, Bs	Alligata	32K	C	AG	£9.95
Flush	Ut	Micro-Aid	16K	C	IZ	£1.00
Football Pools Predictor	Do	Mayday Software	16K	C	IX	£4.99
Footer	Gm	Program Power	32K	C	GK	£7.95
Forecast	Bs	Acornsoft	32K	C	AL	£11.90
Forecasting-single exponential	BS	Micropax	32K	C	MP	£4.95
Forecasting-double exponential	Bs	Micropax	32K	C	MP	£7.95
Forth	Ut	Aztec	32K	C	AZ	£16.85
Forth	Ut	H.C.C.S.	8K	C	HC	£34.72
Forth	Ut	Level 9 Computing	16K	C	CU	£15.00
Forth Toolkit	Ut	Level 9 Computing	32K	C	CU	£10.00
FORTH	Ut	Acornsoft	32K	C	AL	£16.85
Fraction Chase	Ed	GED Software	32K	C	GD	£4.00
Fractions	Ed	Garland	32K	C	JX	£7
Fracts	Ed	Cottage Soft	32K	C	CT	£7.50
French Irregular Verbs	Ed	Carsondale	32K	C	CD	£18.86
French Mistress 1/2	Ed	Kosmos	32K	C	KM	£9.95
French Vocabulary	Ed	Hargreaves	32K	C	HG	£6.50
French Text Fill	Ed	Carsondale	32K	C	CD	£9.95
French Tutor	Ed	Salamander	32K	C	SA	£9.95
Fractions Illustrated 1	Ed	RJE Software	32K	C	RJ	£5.95
Fractions Illustrated 2	Ed	RJE Software	32K	C		RJ£5.95
Frenzy	Gm	Persoft	16K	C	IY	£5.75
Frogger	Gm	Superior Software	32K	C	SE	£7.95
Frogjump	Gm	Sapphire	32K	C	SH	£5.95
Frogger (Machine Code)	Gm	A&F Software	32K	C	GE	£8.00
Fruit Machine	Gm	Superior Software	32K	C	SE	£7.95
Fruit Machine	Gm	Bug Byte	32K	C	KP	£5.50
Fruit Machine	Gm	Alligata	32K	C	AG	£4.95
Fruit Machine	Gm	Computersmith	32K	C	LC	£5.50
Fruity	Gm	Odyssey	32K	C	OG	£3.00
Fun to Learn	Ed	Shards Soft	32K	C	SH	£6.95
Fun Pack	Gm	Sapphire	32K	C	SH	£5.95
Fun Sums	Ed	Kosmos	16K	C	KM	£4.95
Fun with Words	Ed	Golem	32K	C	OB	£8.95
Fun with Words	Ed	Golem	32K	C	OB	£8.00
Fun Games	Gm	B.B.C.	16K	C	KB	£10.00
Galactic Commander	Gm	Micro Power	32K	C	GK	£6.95
Galactic Firebird	Gm	Kansas	32K	C	KA	£9.50
Galactic Wipeout	Gm	R. H. Electronics	32K	C	RH	£8.95
Galaxians	Gm	Superior Software	32K	C	SE	£7.95
Galaxy Wars	Gm	Bug-Byte	32K	C	BB	£7.50
Games Compendium B1/3	Gm	Salamandar	32K	C	NZ	£6.95
Games Pack 1/2	Gm	Processor Applications	32K	C	AP	£5.95
Games Pack 1	Gm	Computersmith	32K	C	LC	£5.50
Games Tape 1	Gm	Pro Software	16K	C	SP	£7.95
Games Pack 1	Gm	Computersmith	16K	C	LC	£5.50
Game of Logic	Ed	N. Darwood	16K	C	JB	£8.00
Games of Logic and cunning	Gm	Golem	16K	C	OB	£9.20
Games of Strategy	Gm	B.B.C.	16K	C	KB	£10.00
Games Pack II	Gm	Micromail	32K	C	OE	£6.75
G.B. Geograph6	Ed	Primasoft	32K	C	PR	£6.95
GCE Maths (O) 1/2	Ed	Bryants	16K	C	HW	£9.50
Genetic Code	Ed	Garland Comp.	32K	C	JX	£17.65
Geography Map	Ed	Bryants	32K	C	HW	£4.85
Geography/France/Germany/Italy/U.S.A./Spain/India	Ed	Corona	32K	C	JY	£5.00
German Irregular Verbs	Ed	Carsondale	32K	C	CD	£13.80
Get it Right	Ed	Sulis	32K	C	SU	£9.95
Ghost/Diamonds	Gm	A Lane	16K	C	0C	£3.00
Ghost Maze	GM	Software for All	32K	C	HN	£6.95
Gideon's Gamble	Gm	Superior Software	32K	C	SE	£7.95
Glooper	Gm	Microplus	32K	C	AM	£6.95
Glycolysis – TCA Cycle	Ed	Garland	32K	C	JX	£15.00
Gobbler	Gm	M G B	32K	C	MG	£5.45
Golf	Gm	Microplus	32K	C	AM	£4.95
Golf	Gm	Computersmith	32K	C	LC	£5.50

Grand Prix	Gm	Software for All	32K	C	HN	£5.95
Grand Prix	Gm	Microplus	16K	C	AM	£4.25
Graph Capers, Junior	Ed	Gem	32K	C	GM	£7.50
Graph Capers Senior	Ed	Gem	32K	C	GM	£8.50
Graphs	Ed	Bryants	16K	C	HW	£4.85
Graphics Aid Pack	Ed	Microwave NW	32K	C	MW	£8.95
Golf	Gm	Bryants S/W	32K	C	HW	£4.88
Golf	Gm	Bug Byte	32K	C	GA,EA	£7.00
Golf	Gm	Computersmith	32K	C	LC	£5.50
Gomoku	Gm	Micro Power	16K	C	GK	£3.95
Graphics Package	Ut	Salamander Software	32K	C	NZ	£24.95
Graph and Charts Pack	Bs	Acornsoft	32K	C	AL,GA	£9.95
Graphics Pack	Ut	Bug Byte	32K	C	BB	£9.50
Graphs (Arithmetical)	Ed	Bryants	32K	C	HW	£4.85
Great Britain Ltd	Gm	S.W. Hessel S/W	32K	C	IW	£5.95
Great Britain Ltd	Gm	Hessel	32K	C	HS	£5.95
Gridrunner	Gm	Salamandar	32K	C	NZ	£7.95
Grig Blitz	Gm	Computercat	32K	C	CC	£5.95
Group Statistics	Bs	Micropax	32K	C	MP	£7.95
Guided Discovery	Ed	Etna Software	32K	C	ET	£9.95
Gunsmoke	Gm	Software Invasion	32K	C	IS	£7.95
Guzzler	Gm	Computersmith	32K	C	LC	£5.50
Handwriting 1/2	Ed	Chalksoft	32K	C	CH	£9.95
Hangdroid	Gm	Micromode	32K	C	MO	£4.00
Hangman	Ed	Micro Aid	32K	C	IZ	£7.95
Hangman Player	Ed	Square	16K	C	SQ	£7.00
Hangman	Gm	Micro Aid	32K	C	IZ	£7.95
Hangman	Gm	Aztec S/W	16K	C	IB	£5.50
Hangman	Gm	MP S/W	32K	C	JZ	£4.00
Happy Letters	Ed	Bowne	32K	C	BO	£8.97
Happy Numbers	Ed	Bowne	32K	C	BO	£8.97
Harmony	Ut	Doctor Soft	32K	C	DS	£6.95
Heist	Gm	Softspot	32K	C	SF	£6.95
Helicopter Rescue/Tunnel/ Roadrace	Gm	A Lane	16K	C	OC	£4.00
Hell Driver	Gm	Program Power	32K	C	GK	£7.95
Hide and Seek	Ed	A.S.K	32K	C	Ak	£9.95
History Quiz	Do	Acornsoft	32K	C	AL	£12.65
Hitch Hiker	Gm	Computer Concepts	32K	C	GJ	£7.80
Home Accounts	Do	Diamondsoft	32K	C	DS	£14.95
Home Accounts	Bs	Gemini	32K	C	GM	£19.95
Home Accounts	Do	Persoft	32K	C	IY	£12.50
Home Finance	Do	B.B.C.	16K	C	KB	£10.00
Hooked on Numbers	Ed	Acornsoft	32K	C	AL	£9.95
Hopper	Gm	Acornsoft	32K	C	AL, GA	£9.95
Horror Castle	Gm	A&F	32K	C	GE	£8.00
Howszat	Gm	A&F	32K	C	GE	£6.90
Human Blood Groups	Ed	Garland	32K	C	JX	£15
Hunchback	Gm	Superior Software	32K	C	SE	£7.95
Hydraulics	Ed	Database Software	16K	C	NU	£5.50
Hyperdrive	Gm	IJK	32K	C	IT	£6.50
'. . . I Do'	Do	Acornsoft	32K	C	AL	£12.65
Index	Ut	Microwave NW	32K	C	MW	£6.95
Index Numbers-Basket	Bs	Micropax	32K	C	MP	£7.95
Index Numbers Changer	Bs	Micropax	32K	C	MP	£7.95
Inheritance	Gm	S.W. Hessel S/W	32K	C	IW	£5.95
Inheritance	Ed	Garland Comp.	32K	C	JX	£34.70
Inkosi	Gm	Chalksoft	32K	C	KT	£5.95
Intervention commercial	Bs	System	32K	C	SY	£345.00
Intervention educational	Ed	System	32K	C	SY	£115.00
Intro	Ed	Clares	16K	C	CL	£7.95
Introducing Map Skills 1/2	Ed	CUP	32K	C	UP	£18
Introduction to Microcomputing in Teaching	Ed	Hutchinson	32K	C	HN	£17.25
Introduction to National Income Models	Ed	Beecon Edsoft	32K	C	BE	£15.95
Invaders	Gm	MP Software	32K	C	MP	£6.50
Invaders	Gm	Software Invasion	32K	C	IS	£6.95
Invaders	Gm	Superior Software	32K	C	SE	£7.95
Invaders	Gm	Software for All	16K	C	KN	£6.95
Invaders	Gm	Hexagon S/W	16K	C	JA	£6.00
Invaders	Gm	MP S/W	32K	C	JZ	£6.50
Invisible Man	Ed	Chalksoft	32K	C	KT	£5.95
Invoicing	Bs	Acornsoft	32K	D	AL	£24.95
Invoices and Statements	Bs	Gemini	32K	C	GM	£19.95
Janeplus	Ed	Longman	32K	C	LM	£14.50
Jars	Ed	Acornsoft	32K	C	AL, GA	£11.90
JCB Digger	Gm	Acornsoft	32K	C	AL	£9.95
Johnny Reb	Gm	Lothlorien	32K	C	LO	£6.95
J.R.	Gm	Software for All	32K	C	KN	£6.95
Jumbles	Ed	Bryants S/W	32K	C	HW	£4.88

SOFTWARE SUPPLIERS

JS *J.C. Software*
124 Woodlands Way
Southwater
West Sussex
RH13 7DR

JX *Garland Computing*
35 Dean Hill
Plymouth PL9 9AF

JY *Corona Software*
Corona House
21 Tennyson Avenue
London E11 2QN

JZ *MP Software & Services*
165 Spital Road
Bromborough
Merseyside L62 2AE

KA *Kansas City Systems*
Unit 3
Sutton Springs Wood
Chesterfield S44 5XF

KB *BBC Publications*
British Broadcasting Corporation
35 Marylebone High Street
London W1M 4AA

KF *Kingfisher Computer Services*
Durley Lane
Keynsham
Bristol BS18 2AQ

KH *Superior Software*
69 Leeds Road
Bramhope
Leeds

KM *Kosmos*
1 Pilgrims Close
Harlington
Dunstable
Bedfordshire
LU5 6LX

KN *Software for All*
72 North Street
Romford
Essex

KU *Kudusoft*
130 Main Street
Tweedmouth
Berwick-upon-Tweed
TD15 2AW

NC *National Extension College*
18 Brooklands Avenue
Cambridge

NP *Program Direct*
37B New Cavendish Street
London W1M 8JR

NR *Foilkade*
Dept PR14
66 Littledean
Yate
Bristol BS17 4UQ

NT *Digital Fantasia*
24 Norbreck Road
Norbreck
Blackpool

NU *Database Software*
97 Defoe Drive
Park Hill
Stoke-on-Trent

NV *CJE Microcomputers*
25 Henry Avenue
Rustington
West Sussex BN16 2PA

NW *Eduquest*
Thames Avenue
Windsor
Berkshire SL4 1QP

NX *Davansoft*
1 Delapoer Drive
Haverfordwest
Dyfed SA61 1HX

NZ *Salamander Software*
27 Ditchling Rise
Brighton
East Sussex BN1 4QL

OA *Anirog Computers*
26 Balcombe Gardens
Horley
Surrey

OB *Golem Ltd*
77 Qualitas
Bracknell
Berkshire RG12 4QG

OC *A Lane (Software)*
12/316 Seaside
Eastbourne
East Sussex BN22 7RH

OD *ASP Software*
145 Charing Cross Road
London WC2H 0EE

OE *Micromail*
PO Box 34
Leighton Buzzard LU7 8SJ

OF *Swift Link Software*
118-120 Wardour Street
London W1V 4BT

OG *Odyssey Software*
8 Greenbrook Avenue
Hadley Wood
Barnet
Herts EN4 0LS

OH *Edu-CAL*
28 Ingersoll Road
Shepherds Bush
London W12 7BD
01 743 1579

OT *Oxhey Tutors*
19 Tudor Walk
Watford
Herts WD2 4NY

LA *Ludinski Computer-Assisted Learning*
24 Avondale Avenue
Staines
Middlesex

LC *Computersmith*
40 Greenfields Avenue
Bromborough
Wirral
Merseyside L62 6DD

LM *Longman Group*
Longman House
Burnt Mill
Harlow
Essex

LO *Lothlorien*
56a Park Lane
Poynton
Cheshire SK12 1AE

MB *Microbyte Software*
Freepost
Newquay TR7 2BR

MD *MED*
640 Melton Road
Thurmaston
Leics

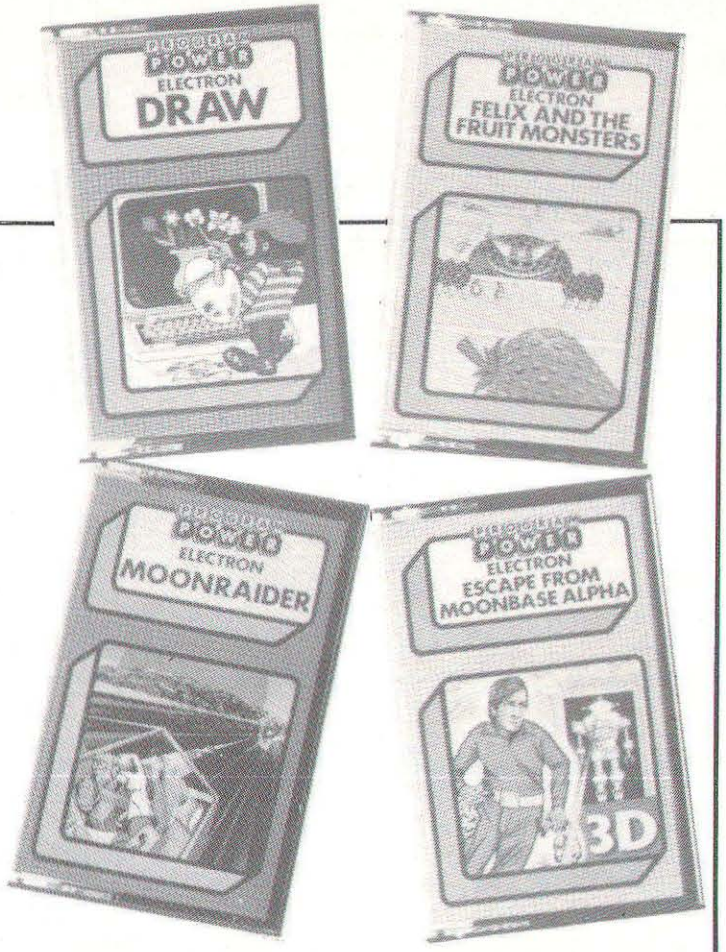
MI *Microgame Simulations*
73 The Broadway
Grantchester
Cambridge
CB3 9NQ

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
Jumbo	Gm	Molimerx	32K	C	AJ	£17.25
Jungle Ambush	Gm	Kindsoft	32K	C	KU	£6.50
Junior Maths	Ed	Aztec	16K	C	AZ	£3.00
Junior Maths Pack	Ed	Program Power	32K	C	GK	£6.95
Junior Word Splits	Ed	Sulis	32K	C	SU	£9.95
Just a Mot	Ed	Sulis	32K	C	SU	£9.95
Katakombs	Gm	Golem	32K	C	0B	£9.20
Keyrecog	Ed	Ed. Soft	32K	C	ES	£4.95
Kidney	Ed	Garland	32K	C	JX	£12
Kingdom of Hamil	Gm	Acornsoft	32K	C	AL	£9.95
Killer Gorilla	Gm	Program Power	32K	C	GK	£7.95
Konexion	Gm	M and M Software	16K	C	MM	£5
Kremlin	Gm	Doctor Soft	32K	C	DO	£6.95
Labyrinths of La Coshe	Gm	Program Power	32K	C	GK	£7.95
Landfall	Gm	Virgin Games	32K	C	VG	£7.95
Language Tutor	Ed	Rainbow Research	32K	C	RR	£5.00
La Princesse (French)	Ed	Aztec S/W	32K.	C	IB	£6.50
Language-Lab	Ed	M and M Software	16K	C	M&M	£7.50
Landfall & Serpent	Gm	GT Software	32K	C	JW	£6.50
Laser Command	Gm	Program Power	32K	C	GK	£7.95
Laser Zone	Gm	Salamander	32K	C	NZ	£7.95
Launching Logic	Ed	Shiva	32K	C	SV	£14.95
Learn Addition	Ed	ABC Primary	32K	C	AB	£6.50
Learn Subtraction	Ed	ABC Primary	32K	C	AB	£6.50
Leap Frog	Gm	IJK Software	32K	C	IJ	£7.50
Ledger	Bs	Micro Aid	32K	C	IZ	£5.95
Letters	Ed	Chalksoft	32K	C	CH	£6.95
Let's Count	Ed	A.S.K	32K	C	AK	£9.95
Library Classification	Ut	Aztec	16K	C	AZ	£6.50
Library Dewey Classification	Ed	Aztec S/W	32K	C	IB	£6.50
Life	Gm	Ixion	16K	C	IN	£4.75
Life Plus	Gm	Mayday	16K	C	IX	£4.49
Lift off with Numbers	Ed	Shiva	32K	C	SV	£14.95
Linear Programming	Bs	Micropax	32K	C	MP	£12.95
Linear Regression, Correlation	BS	Micorpax	32K	C	MP	£7.95
Lines and Angles	Ed	4MAT	32K	C	FM	£5
Link-4-Plus	Gm	ABC Software	16K	C	KR	£6.95
Lisp	Ut	Acornsoft	32K	C	AL.GA	£16.85
Lisp	Ut	Aztec	32K	C	AZ	£16.85
Logo-Forth	Ut	H.C.C.S.	16K	E	HC	£59.00
Logo 2	Ut	Computer Concepts	32K	C	GJ	£10.00
Longitudinal Waves	Ed	Heinemann	32K	C	EH	£12.50
Look it up	Ed	GED Software	32K	C	GD	£4.50
Lorry/Farm	Ed	Primary Programs	32K	C	PP	£3.95
Lost City	Gm	Superior Software	32K	C	SE	£7.95
Lunar Rescue	Gm	Alligata	32K	C	AG	£7.95
L Trap	Gm	Gem	32K	C	GM	£8.50
Lunar Lander	Gm	A&F Software	32K	C	GE	£6.90
Magic Adventure	Gm	Kansas	32K	C	KA	£8.50
Mailer	Ut	ASD Ltd	32K	C	AS	£5.75
Mailing List	Bs	Gemini	32K	C	GM	£19.95
Mailing A	Bs	Micro-aid	16K	C	IZ	£3.95
Mailing B	Bs	Micro-Aid	16K	C	IZ	£3.95
Mailing System	Bs	Acornsoft	32K	D	AL	£24.95
Map Rally	Ed	Bourne	32K	C	BO	£8.97
Mansion Murders	Gm	Challenge Games	32K	C	CG	£6.95
Mark Book	Ed	Carvells	16K	C	CA	£5
Mark Book	Ed	BBC	16K	C	KB	£15
Martians	Gm	Micro Power	32K	C	GK	£5.95
Masterbard Hamlet	Ed	Sulis	32K	C	SU	12.95
Master Copier	Ut	Aztec	16K	C	AZ	£6.50
Master Copier	Ut	Aztec S/W	16K	C	IB	£6.50
Masterfile	Ut	Beebug	32K	CD	BE	£10.00, £19.00
Mastermind	Gm	Micro Power	16K	C	GK	£3.95
Maths Invaders	Ed	Stell	32K	C	ST	£7.95
Maths Man	Ed	GED Software	32K	C	GD	£4.00
Mathspell	Ed	Diamondsoft	32K	C	DS	£7.95
Maths Topics 1	Ed	CUP	32K	C	UP	£18
Maths Translation	Ed	Corona S/W	32K	C	JY	£5.00
Matching	Ed	Clares	16K	C	CL	£5.95
Maze Invaders	Gm	Micro Power	32K	C	GK	£4.95
Maze Man	Gm	C J E Microcomputers	32K	C	NV	£6.00
Micro Budget	Do	Micro Power	16K	C	GK	£6.95
Meditor	Ut	MED	32K	C	MD	£9.50
Medmon	Ut	MED	16K	C	MD	£9.95
Membership Manager	Do	Acornsoft	32K	C	AL	£9.95
Memocalc	Bs	Microaid	32K	C	IZ	£9.95
Mental Arithmetic Tests	Ed	Small School	32K	C	SM	£6.95
Mercy Mission to Mars	Gm	D.A.C.C.	32K	C	DC	£5.95
Meteors	Gm	Acornsoft	32K	C	AL. GA	£9.95
Metrics (5)	Ed	Chalksoft	32K	C	KT	£9.95
Microbial Pop. Dynamics	Ed	Microwave NW	32K	C	MW	£7.00
Micro Man	Gm	Pro S/W	32K	C	LD	£8.00
Micro Maths	Ed	LCL	16K	C	KA	£24.50
Middle Kingdom	Gm	Pro Software	16K	C		£7.95
Microtext	BS	Acornsoft	32K	C	AL	£49.85
Microtype	Ed	Kansas	32K	C	KA	£12.50
Miner	Gm	Ixion	32K	C	IN	£6.90
Minefield	Gm	Eduquest	16K	C	NW	£5.95
Minefield	Gm	A&F Software	16K	C	GE	£6.00
Missile Base	Gm	Acornsoft	32K	C	AL. GA	£9.95
Missile Control	Gm	C J E Microcomputers	32K	C	NV	£9.00
Missing Signs	Ed	Acornsoft	16K	C	AL	£11.90
Mission Impossible	Gm	Aztec S/W	16K	C	IB	£6.50
Mitosis	Ed	Garland	32K	C	JX	£15
Mixed Games	Gm	I.J.K. S/W	16K	C	IT	£3.95
MMaths	Ed	Ed. Soft	32K	C	ES	£4.95
Model A Invaders	Gm	I.J.K. S/W	16K	C	IT	£4.95
Model B Invaders	Gm	I.J.K. S/W	32K	C	IT	£6.95
Moments + Van	Ed	RJE Software	32K	C	RJ	£4.95
Money Box	Ed	Bryants	16K	C	HW	£4.85
Monster Maze	Ed	Kingfisher	16K	C	KF	£6.90
Monsters	Gm	Acornsoft	32K	C	AL.GA	£9.95
Monster Battles	Gm	Bryants S/W	32K	C	HW	£4.80
Moon Raider	Gm	Program Power	32K	C	GK	£7.95
Morse Code	Ed	Philip Dodderidge	32K	C	PD	£6.50
Morse Code Fun	Ed	Aztec	16K	C	AZ	£3.00
Moving Molecules	Ed	C.U.P	32K	C	CP	£13.95
Mr T's Alphabet Games	Ed	Ebury	32K	C	EB	£12.95
Mt T's Measuring Games	Ed	Ebury	32K	C	EB	£12.95
Mr T's Monet Box	Ed	Ebury	32K	C	EB	£12.95
Mr T's Number Games	Ed	Ebury	32K	C	EB	£12.95
Mr T's Shape Games	Ed	Ebury	32K	C	EB	£12.95
Mr T Tells The Time	Ed	Ebury	32K	C	EB	£12.95
Multifile	Bs	Bug Byte	16K	C	EA	£25.00
Multiple Choice	Ed	Eduquest	32K	C	NW	£25.00
Multiply and Divide	Ed	Cottage Soft	16K	C	CT	£7.50
Munchyman	Gm	Micro Power	16K	C	GK	£5.95
Music	Ed	Ed. Soft	32K	C	ES	£9.95
Music	Do	B.B.C.	16K	C	KB	£10.00
Music Editor	Ed	System	32K	C	SY	£9.00
Music Maker	Gm	Rainbow S/W	16K	C	KS	£3.50
Music Synethesiser	Ut	Bug-Byte	32K	C	BB	£9.50
Music Master	Ed	Merlin	32K	C	MN	£6.95
Music Processor	Gm	Quicksilva	16K	C	QS	£14.95
Music Quiz	Do	Acornsoft	32K	C	AL	£12.65
Musictools 1	Ut	Musicsoft	32K	C	MS	£5.75
Musical Numbers	Ed	Bryants S/W	32K	C	HW	£4.88
Musical Number Box	Gm	Bryants S/W	16K	C	HW	£3.75
Mutant Invaders	Gm	I.J.K. S/W	16K	C	IT	£5.95
MX 80 Type 3 Screen Dump	Ut	Software for All	16K	C	KN	£6.95
Nominal Ledger	Bs	Micropower	32K	C	GK	£7.99
Note Invaders Package	Ed	Chalksoft	32K	C	CH	£9.25
Number Balance	Ed	Acornsoft	16K	C	AL. GA	£11.90
Networks-Basic	Bs	Micropax	32K	C	MP	£12.95
Networks-Pert.	Bs	Micropax	32K	C	MP	£17.95
Networks-Big Part	Bs	Micropax	32K	D	MP	£75.00
Number Bond	Ed	Primary Programs	32K	C	PP	£3.95
Number Chaser	ED	A.S.K	32K	C	AK	£9.95
Number Puzzler	Ed	A.S.K	32K	C	AK	£9.95
Number Gulper	Ed	A.S.K	32K	C	AK	£9.95
Number Rally	Ed	Longman	32K	C	LM	£9.95
Number Skills 0-20	Ed	Longman	32K	C	LM	£9.95
Number Skills 0-999	Ed	Longman	32K	C	LM	£9.95
Oblivion	Gm	Bug-BYte	32K	C	BB	£7.50
Old Father Time	Gm	Bug-Byte	32K	C	BB	£9.50
Oil	Gm	Computersmith	32K	C	LC	£5.50
One to Nine	Ed	Acornsoft	32K	C	AL	£9.95
Optimon	Ut	Optima	32K	C	OP	£9.95
Optics	Ed	Hutchinson	32K	C	HN	£18.40

Options	Ed	System	32K	C	SY	£23.00
Options Table	Ed	A. J. Vision	32K	C	AV	£14.95
Order Processing	Bs	Acornsoft	32K	D	AL	£24.95
Oscilloscope	Ed	RJE Software	32K	C	RJ	£6.95
Othello	Gm	Computer Concepts	16K	C	GJ	£8.95
Othello	Gm	Computer Concepts	32K	C	GJ	£8.95
Othello	Gm	Computercat	32K	C	CC	£8.95
Othello	Gm	Sapphire	32K	C	SH	£5.95
Painter	Gm	A & F	32K	C	GE	£8.00
Painting	Ut	BBC	16K	C	JB	£6.0
Paras	Gm	Lothlorien	32K	C	LO	£6.95
Pareto Anlysis	B	Micropax	32K	C	MP	£7.95
Parity	Ed	N. Darwood	16K	C	JB	£10.00
Pascal	Ed	Chalksoft	32K	C	KT	£5.95
Payroll 2	Bs	Micro-Aid	32K	C	IZ	£13.95
Pecko Computer	Bs	Acornsoft	16K	C	AL,GA	£9.95
Peggit	ED	Ed. Soft	32K	C	ES	£5.95
Pentiles	Ed	Silverlind	32K	C	SL	£6.95
Perseus and Andromeda	Gm	Digital Fantasia	32K	C	NT	£10.29
Personal Accounts	Do	Kansas	32K	C	KA	£10.50
Personal Money Management	Do	Acornsoft	32K	C	AL	£11.90
Pete the Plastered Postman/ Asteroid Lander	Gm	ASP Software	16K	C	OD	£8.50
Pharoah's Tomb	Gm	A&F Software	32K	C	GE	£8.00
Philosopher's Quest	Gm	Acornsoft	32K	C	GA	£9.95
Physics	Ed	Program Power	16K	C	GK	£6.95
Picture Maths	Ed	A J Visions		C	AV	£9.95
Picture Spell	Ed	GED Software	32K	C	GD	£5.00
Pieman	Gm	Musicsoft	32K	C	MS	£3.75
Pinball	Gm	Microbyte	32K	C	MB	£5.95
Perspective	Ut	Aztec	32K	C	AZ	£6.50
Picasso GS	Ut	Odyssey	32K	C	OG	£4.50
Picsave	Ut	Hexagon S/W	16K	C	JA	£6.00
Picture Maker	Ut	Acornsoft	32K	C	AL	£9.95
Pirate	Ed	Chalksoft	32K	C	CH	£9.25
Planes	Gm	A&F	32K	C	GE	£8.00
Planet Invaders	Gm	Merlin	32K	C	MN	£7.95
Planetoid	Gm	Acornsoft	32K	C	AL, GA	£9.95
Plegaron People Eaters	Gm	R. H. Electronics	32K	C	RH	£8.95
Population Growth	Ed	C.U.P.	32K	C	CP	£13.95
Poker Dice	Gm	Program Power	32K	C	GK	£5.95
Powerboat Race	Gm	Futura S/W	32K	C	JC	£7.95
Polaris	Gm	Bug Byte	32K	C	KP	£5.50
Pontoon	Gm	M and M Software	32K	C	M	£5
Procaid	Ut	Micro Aid	16K	C	IZ	£3.45
Procflush	Ut	Micro-Aid	16K	C	IZ	£1.00
Procvar	Ut	Micro-Aid	16K	C	IZ	£1.95
Proteans	Gm	D.K. Tronics	32K	C	DK	£6.95
Princess	Gm	Aztec S/W	16K	C	IB	£6.50
Protector	Gm	Quicksilva	32K	C	QS	£7.95
Pub games/Picasso package	Gm	Starsoft	32K	C	SR	£9.95
Punc-Man	Ed	Chalksoft	32K	C	KT	£7.95
Punctuation	Ed	Bryants S/W	32K	C	HW	£4.88
Purchasing	Bs	Acornsoft	32K	D	AC	£24.95
Questionmaster	Ed	Hutchinson	32K	C	HN	£28.75
Q Bert	Gm	Superior Software	32K	C	SE	£7.95
Railroader	Ed	Stell	32K	C	ST	£7.95
Record Changer	Bs	AJ Vision	32K	C	AV	£19.95
Record Keeper	Ut	BBC Pubs	32K	C	KB	£13.80
Recover	Ut	Baksoft	16K	C	BK	£6.00
Revenge of Zopr	Gm	Kansas	32K	C	KA	£9.50
Reversi	Gm	Microbyte	32K	C	MB	£5.95
Reversi	Gm	Kansas	32K	C	KA	£6.25
Reversi	Gm	Silverlind	32K	C	SL	£6.95
Reversi 1	Gm	Program Power	16K	C	GK	£5.95
Reversi 2	Gm	Program Power	32K	C	GK	£5.95
Ripple Tank	Ed	RJE Software	32K	C	RJ	£7.95
Road Runner	Gm	Superior Software	32K	C	CH	£7.95
Road Safety	Ed	Bryants	16K	C	HW	£4.85
Robotic Sums	Ed	GED Software	32K	C	GD	£4.50
Robot	Gm	Miking S/W	32K	C	KC	£4.95
Rocket Raid	Gm	Acornsoft	32K	C	AL, GA	£9.95
Roman Empire	Gm	Lothlorien	32K	C	LO	£6.95
Roulette	Gm	Program Power	16K	C	GK	£5.95
Row of Four	Gm	Software For All	32K	C	KN	£6.95
Royalty Quiz	Do	Acornsoft	32K	C	AL	£12.65
Russian Irregular Verbs	Ed	Carsondale	32K	C	CD	£21.00
Russian Text Fill	Ed	Carsondale	32K	C	CD	£11.96
Scales and Decimal Estimation	Ed	RJE Software	32K	C	RJ	£3.95



SOFTWARE SUPPLIERS

MG *MGB Software Support*
52 Barley Croft
Harlow
Essex

MK *David McKeran*
23 Warwick Drive
East Herrington
Sunderland
Tyne and Wear

MM *M and M Software*
1391 Leek Road
Abbey Hulton
Stoke-on-Trent
Staffs ST2 8BW

MN *Merlin Computer Products*
18 Mansel Street
Swansea SA1 5SG

MO *Micromode*
32 West End Avenue
Gatley
Cheshire

MP *Micropax*
38 Garrick Green
Old Catton
Norwich
NR6 7AN

MS *Musicsoft*
12 Fallowfield
Ampthill
Beds

MW *Microwave NW*
24 Belford Road
Stretford
Manchester M32 0DL

OP *Optima Software Ltd*
36 St. Petersgate
Stockport SK1 1HL

PD *Philip Dodderidge*
4 Grange Close
Woodford Green
Essex IG8 9JS

PR *Primasoft*
2 Spinney Close
Glossop
Derbyshire

PS *Psion Ltd*
2 Huntsworth Mews
Gloucester Place
London NW1 6DD

QS *Quicksilva Ltd*
Palmerston Park House
13 Palmerston Road
Southampton SO1 1LL

QT *Qualitysoft*
4 James Close
Bridgend
Glamorgan CF32 9SJ

RJ *RJE Software*
143 Montague Road
Leytonstone
London E11 3EW

PP *Primary Programs*
Claypits
Debden Road
Saffron Walden
Essex CB11 3JS

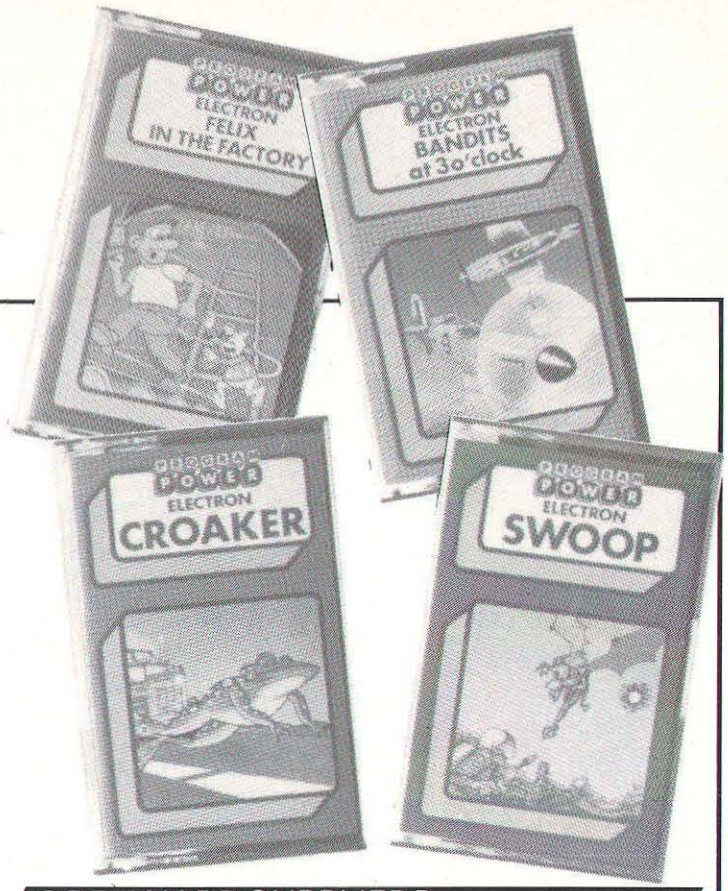
RA *Ratco Software*
3/177 College Road
Moseley
Birmingham B13 9LJ

RH *R. H. Electronics*
Chesterton Mill
French's Road
Cambridge CB4 3NP

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory		Software Supplier	Price
Science Fiction Quiz	Do	Acornsoft	32K	C	AL	£12.65
Sets and Operators	Ed	Shiva	32K	C	SV	£14.95
737 Simulator Flight	Gm	Salamandar	32K	C	SA	£9.95
Scramble	Gm	Bg-Byte	16K	C	BB	£6.95
Scred	Bs	Stable	32K	C	CS	£18
Scribe	Bs	Merlin	32K	C	MN	£29.95
Sea Lord	Gm	Bug-Byte	32K	C	BB	£7.50
Sea Wolf	Gm	Optima	32K	C	OP	£8.95
Search for the Jewels	Gm	SJG Soft	32K	C	SJ	£8.95
Searchbas	Ut	Micro-Aid	16K	C	IZ	£1.95
Seed Germination	Ed	Garland Comp.	32K	C	JX	£18.82
Sequences	Ed	Chalksoft	32K	C	CH	£5.95
Shirley Conran's Magic Garden	Do	Acornsoft	3.2 K	C	AL	£9.95
Sheepdog	Ed	Longman	32K	C	LM	£9.95
Sheepdog Trials	Ed	Bryants S/W	32K	C	HW	£4.80
Shootout	Gm	MP S/W	32K	C	JZ	£5.00
Seek	Gm	Program Power	16K	C	GK	£6.95
Sentence Sequencing	Ed	Acornsoft	16K	C	AL, GA	£11.90
Sentence Shaker	Ed	GED Software	32K	C	GD	£4.50
747	Gm	Doctor Soft	32K	C	DO	£7.95
747	Gm	D.A.C.C.	32K	C	DC	£9.95
Shape Generator	Ut	Software for All	32K	C	KN	£11.50
Shapes Package	Ed	GED Software	32K	C	GD	£8.00
Shopping	Ed	GED Software	32K	C	GD	£4.50
Shrinking Professor	Gm	A & F	32K	C	GE	£8.00
Shuttle	Gm	Molimerx	32K	C	MX	£14.95
Signs	Ed	Acornsoft	16K	C	AL, GA	£11.90
Simple Word Processor	Ed	A J Vision	32K	C	AV	£9.95
Simple Queues	BS	Micropax	32K	C	MP	£7.95
Simulation Surgery	BS	Micropax	32K	C	MP	£12.95
Simulation-Carlton Trucks	Bs	Micropax	32K	C	UP	£12.95
6502 Development System	Ut	Acornsoft	32K	D	AL	£49.85
Skwosh	Gm	Miking S/W	32K	C	KC	£3.95
Sliding Block Puzzles	Gm	Acornsoft	32K	C	AL, GA	£9.95
Ski Slalom	Gm	R. H. Electronics	32K	C	RH	£8.95
Slicker Puzzle	Gm	D. K. Tronics	32K	C	DK	£6.95
Snail Trail	Gm	R. H. ELectronics	32K	C	RH	£4.95
Snake	Gm	Kansas	32K	C	KA	£8.50
Snake	Gm	Computer Concepts	32K	C	GJ	£6.67
Snapper	Gm	Acornsoft	32K	C	AL,GA	£9.95
Snig	Gm	Computercat	32K	C	CC	£6.75
Snooker	Gm	Visions	32K	C	VI	£8.95
Snooker	Gm	Acornsoft	32K	C	AL, GA	£9.95
Sort M/C	Ut	Micro-Aid	16K	C	IZ	£1.00
Sortbas	Ut	Micro-Aid	16K	C	IZ	£1.00
Soundplan	Ut	ME & P Products	16K	C	KK	£10.00
Spacehawks	Gm	Computer Concepts	32K	C	GJ	£7.80
Space Adventure	Gm	Virgin Games	32K	C	VG	£7.95
Space Cab	Gm	Kansas	32K	C	KA	£7.25
Space Fighter	Gm	Superior Software	32K	C	SE	£7.95
Space Invaders	Gm	Bug-Byte	32K	C	BB	£5.50
Space Pirates	Gm	Bug-Byte	16K	C	BB	£5.50
S-Pascal	Ut	Acornsoft	32K	C	AL	£16.85
Spacex	Ed	4MAT	32K	C	FM	£10.00
Spaceguard	Gm	MP Software	32K	C	MP	£6.50
Space Hi-way	Gm	Amcom	32K	C	AO	£7.45
Space Kingdom	Gm	Software For All	32K	C	KN	£7.95
Space Maze	Gm	Program Power	32K	C	GK	£7.95
Spacefight	Gm	Miking S/W	32K	C	KC	£7.95
Space Warp	Gm	Bug Byte	32K	C	GA,EA	£11.50
Space Fighter	Gm	MP S/W	32K	C	JZ	£8.50
Space Fighter	Gm	Superior S/W	32K	C	KH	£7.00
Space Games Pack 1	Gm	Futura S/W	16K	C	JC	£3.99
Space Games Pack 2	Gm	Futura S/W	16K	C	JC	£3.99
Space Games Pack 3	Gm	Futura S/W	16K	C	JC	£4.99
Space Games Pack 4	Gm	Futura S/W	16K	C	JC	£4.99
Space Ranger	Gm	Microbyte	32K	C	MB	£7.95
Space Trek	Gm	Program Direct	32K	C	NP	£5.99
Space Pirates	Gm	Bug Byte	16K	C	KP	£8.00
Speechparts	Ed	Bryants S/W	32K	C	HW	£4.88
Speed and Light	Ed	Acornsoft	16K	C	AL, GA	£11.90
Spell 7/Spell 9+	ED	Primary Programs	32K	C	PP	£3.95
Spelltest	Ed	Bryants	16K	C	HW	£4.85
Spellings	Ed	ECL	32K	C	EL	£5.99
Sphinx Adventure	Gm	Acornsoft	32K	C	AL, GA	£9.95
Spreadsheet	Ed	Contex	32K	C	CX	£7.99
Spy	Ut	System	32K	C	SY	£24.15
Squash	Gm	Aztec S/W	16K	C	IB	£5.50
Standards and Variances	Bs	Micropax	32K	C	MP	£7.95
Starbattle	Gm	Kudusoft	32K	C	KU	£5.50
Starlander	Gm	Kudusoft	16K	C	KU	£3.50
Star Patrol	Gm	Kudusoft	32K	C	KU	£6.50
Starship Command	Gm	Acornsoft	32K	C	AL, GA	£9.95
Star Trader	Gm	FBC Systems	32K	C	FB	£9.50
Starfighter	Gm	FBC Systems	32K	C	FB	£7.50
Star Trek Adventure	Gm	Superior Software	32K	C	SE	£7.95
Star Trek	Gm	Program Power	16K	C	GK	£5.95
Star Maze	Gm	Database Software	32K	C	NU	£7.50
Star Patrol	Gm	Kudusoft	32K	C	KU	£6.50
Star Trek	Gm	Micro Power	16K	C	GK	£4.95
Startrek/Candy Floss	Gm	I.J.K. S/W	16K	C	IT	£5.95
Star Treck	Gm	Hexagon S/W	16K	C	JA	£5.50
Statpack	Ed	Micro-Aid	32K	C	IZ	£8.95
Starter Word Splits	Ed	Sulis	32K	C	SU	£9.95
Stock Control	Bs	Acornsoft	32K	D	AL	£24.95
Stock Control	Bs	Gemini	32K	C	GM	£19.95
Stock Control, classification	BS	Micropax	32K	C	MP	£7.95
Stock Control-EOQ	BS	Micropax	32K	C	MP	£7.95
Stock Control-Roq and Rol	Bs	Micropax	32K	C	MP	£7.95
Story 'A'	Ed	Chalksoft	32K	C	KT	£6.95
Story A — Spanish Gold	Ed	Chalksoft	32K	C	CH	£7.95
Storybuilder	Ed	Bryants S/W	32K	C	HW	£4.85
Stock Valuation	Bs	Micropax	32K	C	MP	£7.95
Stock	Ed	System	32K	C	SY	£14.95
Stats 1	Bs	ME & P Products	16K	C	KK	£15.00
Subkiller	Gm	D.K. Tronics	32K	C	DKK	£6.95
Submarines	Ed	GED Software	32K	C	GD	£4.00
Suffixes	Ed	Golem	32K	C	OB	£8.05
Super Fruits	Gm	D. K. Tronics	32K	C	DK	£6.95
Super Invaders	Gm	Acornsoft	32K	C	AL, GA	£9.95
Superlife	Ed	Golem	32K	C	OB	£6.90
Super Spell	Ed	Aztec	16K	C	AZ	£5.50
Supergolf	Gm	Squirrel Software	32K	C	SS	£7.50
Superlife	Gm	Golem	32K	C	OB	£9.20
Super Hangman	Gm	I.J.K. S/W	32K	C	IT	£3.95
Survival	Ed	System	32K	C	SY	£14.95
Survivor	Gm	MP Software	32K	C	MP	£6.50
Swamp Monsters	Gm	M P Software	32K	C	JZ	£6.50
Swoop	Gm	Micro Power	32K	C	GK	£6.95
Tables Test	Ed	Bryants S/W	32K	C	HW	£4.88
Tables	Ed	Bryants	16K	C	HW	£4.85
Tables	Ed	ECL	32K	C	EL	£5.99
Tabel Adventures	Ed	A.S.K	32K	C	Ak	£9.95
Tank Attack	Gm	Gem Software	32K	C	GC	£7.95
Tanks	Gm	Salamandar	32K	C	SA	£7.95
Tape Copy	Ut	Davansoft	16K	C	NX	£7.50
Taxcalc	Ut	BBC Pubs	32K	C	KB	£17.25
Teacher's Toolkit	Ed	Wida Software	32K	C	FY	£30.00
Ten Little Indians	Gm	Digital Fantasia	32K	C	NT	£10.29
Tense French	Ed	Sulis	32K	C	SU	£9.95
Text Grader	Ed	Hutchinson	32K	C	HN	£28.75
Text Print Extension	Ut	Ratco Soft	16K	C	RA	£2.00
Text Processing Pack	Bs	Eduquest	32K	C	NW	£10.00
Theatre Quiz	Do	Acornsoft	32K	C	AL	£12.65
The Frog	Gm	James Hager	32K	C	IV	£6.50
The Golden Baton	Gm	Digital Fantasia	16K	C	NT	£8.95
3-D Mouse Maze	Gm	Rainbow S/W	32K	C	KS	£3.50
3-D Maze	Gm	Hexagon S/W	16K	C	JA	£6.00
3D Maze	Gm	Earthshock S/W	16K	L	KI	£3.00
3D Maze	Gm	I.J.K. S/W	32K	C	IT	£3.95
The Computer Programme Programs Vol 2	Do	B.B.C	32K	C	KB	£10.00
The Computer Programme Programs Vol 1	Do	B.B.C.	16K	C	KB	£10.00
The Golden Baton	Gm	Digital Fantasia	16K	C	NT	£10.29
The Frog	Gm	Software For All	32K	C	KN	£7.95
The Guns of Navarone	Gm	D.A.C.C.	32K	C	DC	£7.95
The Theorem of Pythagoras	Ed	Small School	32K	C	SM	£6.95
The Ring of Time	Gm	Kansas	32K	C	KA	£9.50
The Typing Master	Do	Anthony Ashpitel	32K	C	AA	£20.00
The Wizard of Akyrz	Gm	Digital Fantasia	32K	C	NT	£10.29
The Garden	Ed	Clares	16K	C	CL	£6.95
The Time Machine	Gm	Digital Fantashia	16K	C	NT	£8.95
There	Ed	Golem	32K	C	OB	£8.05
Time	Ed	Stell	32K	C	ST	£7.95
Timeman Two	Ed	Bourne	32K	C	BO	£8.97



Timeman One	Ed	Bourne	16K	C	B	£8.97
Time Series Analysis	Bs	Micropax	32K	C	MP	£7.05
Timetabling OPT 1-6	Ed	Hutchinson	32K	C	HN	£17.25
Timetabling TT 1-6	Ed	Hutchinson	32K	C	HN	£17.25
Time Traveller	Ed	Sulis	32K	C	SU	£9.95
Timetrek	Gm	Micro Power	32K	C	GK	£6.95
Tiny Pascal	Ut	H.C.C.S.	16K	E	HC	£59.00
Titrations	Ed	System	32K	C	SY	£14.95
Toolbox	Ut	BBC Pubs	32K	C	KB	£21.00
Touch Typist	Ed	Computercat	32K	C	CC	£9.95
Touch Type Tutor	Ed	Technical Education	16K	C	TE	£4.95
Towering Inferno	Ed	Sulis	32K	C	SU	£9.95
Tower of Alos	Gm	A&F Software	16K	C	GE	£6.90
Towers	Ed	Bryants	16K	C	HW	£4.85
Towns of Britain	Ed	Aztec S/W	16K	C	IB	£6.50
Towntest	Ed	Silverlind	32K	C	SL	£6.50
Trafalgar	Gm	Acornsoft	32K	C	AL, GA	£9.95
3-D Ice Hockey	Gm	Computersmith	32K	C	LC	£5.50
3 in 1	Gm	R. H. Electronics	16K	C	RH	£7.50
Trafalgar	Gm	Squirrel Software	32K	C	SS	£8.00
2002	Gm	Superior Software	32K	C	SE	£7.95
Tramix	Gm	D. K. Tronics	32K	C	DK	£6.95
Tree of Knowledge	Ed	Acornsoft	16K	C	AL, GA	£9.95
Transistors Revenge	Gm	Soft Spot	32K	C	SF	£6.95
Triangles/Regular Shapes	Ed	Primary Programs	32K	C	PP	£3.95
Twenty Crosswords	Gm	NEC	32K	C	NC	£6.90
Turtle Graphics	Ed	Acornsoft	32K	C	AL	£16.85
Type Easy	Ed	Carswell	32K	C	CR	£8.95
Type Invaders	Ed	Carswell	32K	C	CR	£6.95
Typing Tutor	Ed	Contex	32K	C	CX	£9.99
Ultima-File	Dm	Ixion	16K	C	IN	£7.50
Unoriginal Games	Gm	McKeran	16K	C	MK	£2.00
Util-1	Ut	Gem Software	32K	C	GC	£9.95
Utility Pack	Ut	Computersmith	32K	C	LC	£5.50
Utilities	Ut	Qualitysoft	16K	C	QT	£4.00
Utilities	Ut	ASD Ltd	32K	C	AS	£5.75
Utilities	Ut	Golem	16K	C	OB	£8.05
Utility A	Ut	Micro-Aid	16K	C	IZ	£5.95
Vader Raid	Gm	FBC Systems	32K	C	FB	£7.50
Valley	Gm	ASP Software	32K	C	OD	£11.45
Valley of the Pharoahs	Gm	FBC Systems	32K	C	FB	9.50
Varkman/Meanies	Gm	Aardvark Software	16K	C	IU	£4.00
View Printer Drivers	Ut	Acornsoft	32K	C	AI	£9.95
Views/Faces	Ed	Primary Programs	32K	C	PP	£3.95
Viper	Gm	R. H. Electronics	32K	C	RH	£8.95
Vogon Attack	Gm	Micromail	32K	C	OE	£6.33
Vowels	Ed	Golem	32K	C	OB	£8.05
Vu-calc	Bs	Psion	32K	C	PS	£14.95
Vu-file	Bs	Psion	32K	C	PS	£14.95
Vu-type	Ed	BBC Pubs	32K	C	KB	£16.10
Wall	Gm	Program Power	32K	C	GK	£5.95
Whatsit	Ed	Ed. Soft	32K	C	ES	£4.95
Where?	ED	Primary Programs	32K	C	PP	£3.95
Where?	Ed	Program Power	32K	C	GK	£6.95
White Knight Mark Eleven	Gm	BBC Pubs	32K	C	KB	£11.50
Whitewash	Gm	Amcom	32K	C	AO	£5.95
Whole Number Arithmetic	Ed	RJE Software	32K	C	RJ	£7.95
White Barrows Conquering Everest	Gm	ASP Software	16K	C	OD	£11.45
Wizard	Gm	Quicksilva	32K	C	QS	£6.95
Wolfpack	Gm	Doctor Soft	32K	C	DO	£7.95
Woodstock	BS	Micropax	32K	D	MP	£2.95
Wordflash	ED	Ed. Soft	32K	C	ES	£4.95
Word Hunt	Ed	Acornsoft	16K	C	AL, GA	£11.90
Wordmaster	Ed	Sulis	32K	C	SU	£9.95
Word Perfect	Ut	Doctor Soft	32K	C	DS	£9.95
Wordpower	Ed	Sulis	32K	C	SU	£9.95
Word Processor	Bs	Gemini	32K	C	GM	£19.95
Wordprocessor	Ut	ASD Ltd	16K	C	AS	£5.75
Word Sequencing	Ed	Acornsoft	16K	C	AL, GA	£11.90
Words, Words, Words	Ed	A.S.K	32K	C	Ak	£9.95
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Dear Editor
I enclose two amendments or additions to the CATALOGUE2 program listed in the July/August edition. The first allows pattern matching in the global search procedure to disregard the case of alphabetic characters, i.e. if asked to find records containing the field Balchin it would print out those containing Balchin, BALCHIN or balchin. This is, I feel, a most valuable improvement.

The procedure is named 'lowercase' and works by changing any alphabetic character into lower case before string comparisons are made.

The second extends the use of record searching to allow you to find records which have a numeric field which satisfies some conditions. The choice of conditions is

a. the field equals a given value
b. the field is larger or equal to some value
c. the field is less than or equal to some value
d. the field is between two values.

Thus in a catalogue of cars details you could list all the cars which use 2 star petrol, or all the cars which cost between £4000 and £6000.

May I point out one characteristic of the search procedure that is not quite up to the rest of the program; that is that if searching for 'HONDA' then if one of the fields contains a solitary 'D' then this record will be printed out.

This could be changed by restricting the search to a specific field, as in my second amendment, or by removing the original line 1310.

Editor of A&B Computing Number One, Golden Square, London W1R 3AB.

NOTES on PROClowercase.

P$ is the parameter being the string to be converted. T$ holds the converted string.

The procedure is called in lines 1280 and 1310. Line 1320 also needs to be amended as listed. This is because c1$ is used to hold the contents of ENTRY$(N4,N2) so that they will not be changed during the matching code.

The procedure works by looking at the ASCII code of each character in the string and if the code is between 64 and 91 then it represents an upper case letter and so 32 is added to the code and the string is rebuilt with lower case letters in place of upper case ones.

Notes on PROCfelsearch.

The procedure is called from the MENU where I have replaced option 8 with 'Search on field', although to be strict I should have used 'Search on Numeric field'. This means that line 390 needs to be amended to: 390PRINT"Search on field". Then line 530 needs to be amended to: 530 IF ANSWER=8 THEN PROCfelsearch: GOTO 290.

The procedure has been based on PROCsearch with N% being the number of the field being searched on.

This could be extended to a search on a combination of fields with different conditions, i.e. all cars which have a fuel economy of more than 50 mpg which go at least 100 mph and which cost less than £5000.

If these plus other amendments use too much memory then the program could be split again into two, one part for creating and amending the catalogue and one for using the catalogue.

Yours faithfully
Nigel Balchin
Basingstoke, Hampshire.

Dear Editor
Regrettably, a mixture of author and editor errors afflicted the article 'Angles to Arcs' in the Nov-Dec issue.

Those affecting the running of two routines are:

Triangles: Add line: 55 E=RAD(E)
Substitute (E) for (D) in line 60.

Ellipses: Substitute a comma for M in line 40

```
 1280FLAG=1:N3=0:N1=0:PROClowercase(B$):B$=T$



 1310 C1$=ENTRY$(N4,N2):PROClowercase(C1$):C1$=T$:IF LEN(C1$)<=LEN(B$) THEN IF I
NSTR(B$,C1$)>0 THEN GOTO1390



 13201F LEN(C1$)>LEN(B$) THEN IF INSTR(C1$,B$) 0 THEN GOTO 1390



 3980 REM  PROCEDURE TO CHANGE ANY UPPER CASE ALPHANETIC CHARACTERS INTO LOWER C
ASE
 3982 REM  USED IN PROCglobal
 3985 REM  BY N.J.BALCHIN.
 4000 DEF PROClowercase(P$)
 4010 T$=""
 4020 FOR I%=1 TO LEN(P$)
 4030 ASKEY=ASC(MID$(P$,I%,1))
 4040 IF ASKEY>64 AND ASKEY<91 THEN T$=T$+CHR$(ASKEY+32) ELSE T$=T$+CHR$(ASKEY)
 4050 NEXT
 4060 ENDPROC

 5000 DEF PROCfelsearch
 5010CLS
 5020PRINT COL$;"SEARCH ON NUMERIC FIELD"
 5030IF NUMFEL=1 THEN N%=1:GOTO 5100
 5040VDU10:PRINT"Which field do you wish to do the        SEARCH ON ?"
 5050FOR N1=1 TO NUMFEL
 5060PRINT;N1;" ";FELNAME$(N1)
 5070NEXT N1
 5080INPUT"Type in the correct number: "ANSWER$
 5090N%=INT(VAL(ANSWER$)):IF N%<1 OR N%>NUMFEL THEN PROCREDO:GOTO 5010
 5100 CLS:PRINTCOL$;"SEARCH ON ";FELNAME$(N%);" FIELD";
 5103PRINT
 5105 PRINT"SEARCH CONDITIONS"
 5107VDU10
 5110PRINT"1 FIELD CONTENTS   =      VALUE"
 5115PRINT"2 FIELD CONTENTS < OR =   VALUE"
 5120PRINT"3 FIELD CONTENTS > OR =   VALUE"
 5125PRINT"4 FIELD CONTENTS BETWEEN  VALUES"
 5126 VDU10
 5130 INPUT"Type in the correct number: "ANSWER$:ANS=INT(VAL(ANSWER$)):IF ANS<1
OR ANS>4 THEN PROCREDO:GOTO5100
 5135VDU10
 5140 IF ANS=1 THEN INPUT"VALUE PLEASE ? "RMAX:RMIN=RMAX
 5150 IF ANS=2 THEN INPUT"Maximum value please ? "RMAX:RMIN =-999999999
 5160 IF ANS=3 THEN INPUT"Minimum value please ? "RMIN:RMAX=999999999
 5170 IF ANS=4 THEN INPUT"Minimum value please ? "RMIN:VDU10:INPUT"Maximum value
 please ? "RMAX
 5180 CLS
 5200N3=0:N1=0
 5210N4=1
 5220IF VAL(ENTRY$(N4,N%))<=RMAX AND VAL(ENTRY$(N4,N%))>=RMIN THEN 5270
 5230N4=N4+1
 5240IF N4<=NUMREC THEN 5220
 5250IF N3=0THEN PRINT"No records in catalogue which satisfy   conditions.":GOTO
 5350
 5260 GOTO 5340
 5270 PROCPRIREC(N4)
 5280 VDU10:PRINT"< PRESS SPACEBAR TO FIND ANY MORE        SIMILAR RECORDS. OTH
ERWISE PRESS        RETURN >";
 5290 ANSWER=GET
 5300 IF ANSWER=13 THEN 5370
 5310 IF ANSWER <>32 THEN 5290
 5320 CLS:N3=1:N4=N4+1:GOTO 5240
 5340PRINT"No more matching records."
 5350PRINT"< PRESS RETURN >"
 5360ANSWER=GET:IF ANSWER<>13 THEN 5360
 5370 CLS
 5380 ENDPROC
```

Insert a space between PI and STEP in line 50.

Readers may be interested in converting the routines to give filled, in place of outline, figures. The changes required are these:

Rectangles: In lines 80 and 100, substitute PLOT 85, for DRAW.
Triangles: In line 120, substitute PLOT 85, for DRAW.
Circles: Add lines: 54 PLOT 85,X,Y
56 MOVE
X+B, Y+C.
Ellipses: Add lines: 114 PLOT 85,X,Y
116 MOVE
X+B−H, Y+C−J.
Arcs: Add line: 115 PLOT 85,X,Y

Yours sincerely
J. D. Robinson

Dear Editor
The circle drawing program in J.D. Robinson's article Angles to Arcs takes 3.4 seconds to draw the circle. If a large number of circles is to be drawn, the total time taken might be quite substantial. As an alternative, the following program takes only 0.7 seconds.

```
10 MOVE X, Y+R
20 SI=.173648 : CI=.984808
30 SA=0 : CA=R
40 FOR A% = 1 TO 36
50 TEMP = SA*CI + CA*SI
60 CA = CA*CI − SA*SI
70 SA = TEMP
80 DRAW X+SA, Y+CA
90 NEXT
```

About 2.0 seconds have been saved by taking the sine and cosine claculations outside the loop because these functions involve much more computation than simple multiplications or additions. The program uses the well known equations:

sin(A+I) = sinAcosI + cosAsinI
cos(A+I) = cosAcosI − sinAsinI

which permit the sine and cosine of A (in the original program) to be computed from the previous value of sinA and cosA. CA is COS(A) which is calculated at line 60 and SA is SIN(A) calculated at lines the angular increment, I, between successive plotted points. These do not change during the loop and so are computed once only before entering the loop. SA and CA are given initial values outside the loop. These should be 0 and 1 for a 0 degree angle, but have been multiplied by R at this stage, instead of during the loop, to save time. Thus SA is actually R*SIN(A) and CA is R*COS(A).

A further substantial saving has been obtained by plotting at 10 degree increments instead of the original 6 degree increments, but the user must judge whether he considers this is sufficiently accurate for his purposes.

Some small savings of time have been obtained by writing .173648 and .984808 instead of computing the sine and cosine of 10 degrees, by using an integer counter and by simplifying the loop structure.

Yours sincerely
Dr. S. Taylor
Lecturer, Mechanical Engineering Dept., University of Birmingham.

Dear Editor
I purchased the November/December edition of your magazine and found the range of articles very interesting.

I was particularly interested in the reviews of Wordwise and Beebcalc, having had experience of both devices − it's nice to see what someone else thinks of them! I also noticed that Computer Concepts are withdrawing the current version of Beebcalc. I don't know what they have found wrong with it, I recommended it to a colleague for calculating the cost of the television programmes he produces and he thinks it the best thing since sliced bread!! (In 10 minutes he can do a mornings work)

Further on in the magazine I came across Mr. Shentons (rather longwinded) letter on splitting control codes when using Wordwise. It would appear that Mr. Shenton hasn't read the WW manual as section 5.8 warns about this point.

Now could I comment on WW. I ran into problems getting proper paging, the Page Length (PL) command not appearing to work properly. For example, setting PL60 − 60 lines − gave incorrect paging − even more so if a Begin Page (BP) command was included to force the start of a new page − it gave a Blank Page instead!

The way I overcame the problem is to leave the PL command out (it defaults to 66) and to change the length of the page by using the TS and BS commands (TS = Top Space, BS = Bottom Space). Hence if you want 60 lines per page, set TS and BS to 3.

Also I would suggest that users of WW take a look at the example document included in the pack as it contains a lot of useful hints on the use of control codes if you look carefully as well as making interesting reading.

Yours faithfully
D.S. Buckley,
Harrow, Middx.

Dear Editor
In the Nov/Dec issue of A&B you said you are always interested in the dungeons of O.S.1.2. Well here's a way to get out of the dungeon: VDU23;236;0;0;0; .

No, it's not a memory dump, better than that! It actually re-defines the display area as starting at &0000 instead of &3000 or &5800 or where ever depending upon the MODE.

However the normal screen area is still active in the usual way, so if for instance you precede this statement with MODE 0 then the display consists of the "interesting" locations from &0000 to &3000 and from there on the first part of the usual display region.

At this point one can cursor down to the bottom (off the picture) of the usual display area at which point this facility is turned off (because of scrolling). To stop this, window-off the *top* 12 lines of text.

MODE 0 is probably the best for this because MODE 4 leaves no room for text and MODE 2 doesn't give a proper memory map plus all that flashing is so distracting. MODE 7 of course isn't bit-mapped at all. I hope this small discovery will prove useful.

On a wider theme, defining the first two bytes of character number zero (1,8 and 9 ?!) in this way (VDU23,0,n,m,0;0;0;) facilitates a staggering amount of control over the video processer (e.g. picture height, cursor height etc.) and experimentation is well rewarded.

Yours faithfully
Colin Russ
Kingclere, Berks.

Dear A&B Computing
First of all, excuse me if my English isn't very good. I think you will understand.

I'd like to give you and your readers some good and simple advice about "speeding up programs". I don't possess a "Beeb" yet but I have quite some experience with programming Fortran at a large computer.

The idea is to load sine and cosine values in arrays. It is clear that reading an array is much faster than using the sine function particularly when drawing many circles and so on. See for example the programs "Graphics envelopes" and "Spirobee" in the Nov/Dec issue. I would suggest the next program to illustrate the idea and to make a speed comparison:

```
10 DIM SI(99),CO(99)
20 P=PI/50
30 FOR I=0 TO 24 :
SI(I)=SIN(P*I) : NEXT :
SI(25)=1.0
40 FOR I=26 TO 49 :
SI(I)=SI(50−I) : NEXT
50 FOR I=50 TO 99 :
SI(I)=SI(I−50) : NEXT
60 FOR I=0 TO 74 :
CO(I)=SI(I+25) : NEXT
70 FOR I=75 TO 99 :
CO(I)=SI(I−75) : NEXT
80 TIME=0
90 FOR K%=0 TO 99 :
NEXT : T=TIME : TIME=0
100 FOR K%=0 TO 99 :
S=SIN(1.0) : NEXT
110 PRINT (TIME−T) :
TIME=0
120 FOR K%=0 TO 99 :
S=SI(K%) : NEXT
130 PRINT (TIME−T) : END
```

Remember that each array uses more than 600 bytes! You could use only the SI array or even the SI array up to 25 and

CONTINUED OVER

calculate the other values when necessary. Using the array instead of the function is also more comfortable in for-next loops (less errors).

I hope you want to publish my letter and to get a lot of reactions and new ideas from the readers!

Met vriendelijke groeten,
Hugo Landheer
Mgr. Nolensstraat 46
1505 VG Zaandam
Holland

Dear Editor

Congratulations to Daniel J. Bishop on his excellent program, Christmas Greetings (A&B Computing Nov/Dec 83). However, I found that after carefully checking all of the DATA statements in PROCtree, there were unsightly gaps and colour changes in the picture. I would like to inform other readers of the corrections I found necessary on my machine (BasicII and 1.2 O.S). These mainly concern the Teletext Control Codes.

Line 290 Change last Hex group from 03A0 to 00A0
Line 300 Change first Hex group from 0182 to 0482
Line 310 Change last Hex group from 03A0 to 00A0
Line 320 Change first Hex group from 0182 to 0482
Line 320 Change list Hex group from 03A0 to 01A0
Line 330 Change first Hex group from 0182 to 0382
Line 400 Change last Hex group from 03A0 to 00A0
Line 410 Change first Hex group from 0187 to 0487
Line 420 Change last Hex group from 10A0 to 01A0
Line 430 Change the line to read: 0187019D018101960CA00087019D018101960CA001EA06FF013501A0

All of the rest of the program worked beautifully, after removal of typing errors. In fact I liked PROCnewyear so much that I wanted more of it. So I added an extra FOR — NEXT loop as the first statement in line 2590, and the NEXT in line 2680, to make it go through the procedure three times.

Having only had my BBC for seven weeks, I found the User Guide to be very incomplete on the subject of Teletext. I therefore had to interfere blindly with the control codes until I achieved the desired result. Are there are books specialising in mode 7 (or Teletext) that you can recommend?

Yours faithfully
Mr D. Bilney
Dharan, Saudi Arabia.

Dear Editor

I am writing to tell you of an amendment to the program SPACEWAR published in the last edition of your magazine. The article said that a very good score was one of 9,000. I have managed to score in excess of 30,000 because of a bug in the program. The way to win is to let an alien land, then move the crosshair to the top right hand corner (signifying one alien has landed) as far as it will go. Then move the crosshair down on place with the '/' key. Then the instructions for the game can be summarised as: REPEAT : When alien appears fire and it will blow up : UNTIL bored : END The qwerk is due, I think to the number of aliens landed being in the crosshair sights confusing the program. If the user ammends SPACEWAR as follows this qwerk is eliminated.

```
671  VDU 4,28,3,31,17,31,
     19,15,0;0;:COLOUR
     143:CLS:VDU 26,5
1300 GCOL 0,0 : MOVE
     1088,32 : PRINT ;L%
1320 GCOL 0,2 : MOVE
     1088,32 : PRINT ;L%
1441 VDU 19,15,15;0;
1600 DEFPROCscore : GCOL
     0,0 : MOVE 192,24 :
     PRINT ;0% : GCOL 0,3
     : MOVE 192,24 : PRINT
     ;K% : ENDPROC
```

With this ammendment I have managed to score about 9,000. The only other 'fault' I found with the program was that after scoring more than 1,000 if you dropped to under 1,000 you can still get a pod as the program thinks you still have over 1,000!!

Thank you for an enjoyable magazine although it is a bit on the expensive side. Also two months is quite a long time to wait between issues.

Yours
Darren Dickens
Stevenage, Herts.

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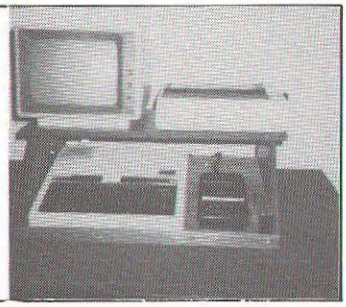

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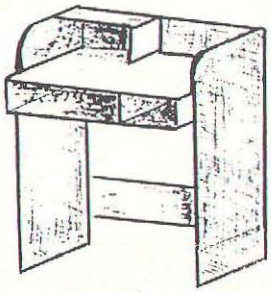

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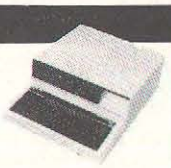

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